



# Comparison among different decommissioning funds methodologies for nuclear installations

**Final Report**

## Country Report France

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funds methodologies for nuclear installations**

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**France**

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## Summary

The regulatory situation and organisation of nuclear decommissioning and waste management in France is in the middle of profound changes. New legislation has just been voted but implementation practice needs yet to be developed. Operators have radically modified their financing and organisational approach to backend activities but cannot yet provide practical experience under the new circumstances. At this particular point in time, it has turned out particularly complex to carry out the present analysis.

After national public and parliamentary debates new legislation on nuclear waste research and management has been adopted on 15 June 06 that includes specific wording on the financing of decommissioning and waste management operations. Key articles of the new *Law on the Programme Relative to the Sustainable Management of Radioactive Materials and Wastes (hereafter New Waste Law)*<sup>1</sup> includes the legal requirement to elaborate a National Plan for the Management of Radioactive Materials and Wastes and a National Inventory of Radioactive Materials and Wastes. Both have to be updated every three years. The National Radioactive Waste Management Agency ANDRA has to set up an internal restricted fund in order to finance the storage of long lived high and medium level wastes. The fund will be fed by contributions from the nuclear operators under bilateral conventions. The nuclear operators have to set up internal restricted funds covered by dedicated assets managed under separate accountability. A National Financing Evaluation Commission of the Costs of Basic Nuclear Installations Dismantling and Spent Fuel and Radioactive Waste Management will be established that comprises representatives of the National Assembly and the Senate as well as the Government and a number of experts that have to be independent of the nuclear operators and the energy industry.

Partial privatisation led key nuclear players AREVA and EDF to advance the reorganisation of their backend provisions and accountancy practice. The CEA is following soon. The three companies have set up restricted internal funds for the financing of future backend charges. The CEA was the first to set up a specific fund for its civil activities in 2001, while AREVA was the first to cover provisions by dedicated assets. EDF is expected to have built up earmarked assets by 2010, which is thought to be the earliest time EDF can complete this.

The sums involved are very significant. The French Court of Accounts has calculated liabilities (= provisions) totalling EUR 65 billion (undiscounted) for the three main operators as of the end of 2004<sup>2</sup>.

While the new legal framework considerably changes the basis for the future availability of sufficient funding for nuclear decommissioning and waste management activities in France, a large number of uncertainties remain. These include:

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<sup>1</sup> Loi de programme relatif à la gestion durable des matières et des déchets radioactifs, 15 June 06, see Annex 7

<sup>2</sup> The figure is even higher, almost € 70 billion, if one does not take into account some overlap stemming from doubling provisions due to joint operation by several operators of some facilities.

- The cost calculations underlying the provisions are non-transparent and there is no public access to the data<sup>3</sup>; the administrative authorities do either have limited manpower<sup>4</sup> or are not consulted.<sup>5</sup> In the past, some cost calculations have proven wrong by an order of magnitude or more.
- The spent fuel management policy choice has extreme impact on future costs. The final disposal cost estimates for long lived high and intermediate level wastes vary by a factor of four or almost 45 billion Euro between 13.5 and 58 billion. The current limitation of the reference scenario to the all-reprocessing option – evaluated as the cheapest geological disposal option<sup>6</sup> – has not been justified.
- There is considerable opposition against the funding scheme adopted (internal restricted), which has led the largest opposition group (Socialist Party) in the French National Assembly in a surprise move to abstain from voting the New Waste Law. Two other parliamentary representations (Communist Party<sup>7</sup>, Green Party) have voted against the law.
- There is opposition against the current backend strategy (reprocessing plus geological storage) from the civil society (NGOs, independent scientists, consumer groups). The implementation of a second laboratory, legally required under 1991 legislation and firmly requested by trade unions and independent experts, has not been possible in the past due to fierce local opposition. Policy changes in the future due to public pressure or legal claims are difficult to exclude.
- The current cost estimates are based on the opening of a final geological disposal site for long lived intermediate and high level wastes in 2020. After six years the laboratory project at Bure is already more than two years behind schedule.
- Safety analysis based modifications of the technical specifications in waste conditioning, packaging and storage can have significant impact on costs.<sup>8</sup>
- The conditioning, sometimes reconditioning, and packaging of some waste categories (bitumen, graphite, spent MOX) is still only in its development phase. Cost calculations necessarily have large uncertainties associated.
- Following the shut-down over a two year period of a nuclear facility (for example after an incident or an accident), the safety authorities can order the final closure and decommissioning of the facility. This could have severe impact on cost calculations and availability of backend funding.
- Some materials currently not classified as waste might have to be managed as waste in the future (for example reprocessed and depleted uranium, a portion of separated plutonium, spent plutonium fuels and plutonium waste).

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<sup>3</sup> The main operators have refused to transmit any cost data to the author.

<sup>4</sup> For example, approximately one dedicated full time staff person per key operator in the Industry Ministry.

<sup>5</sup> The Nuclear Safety Authorities were not invited to join the Industry Ministry led Working Group that elaborated the reference cost scenario for geological disposal in 2005 (see [DGEMP 2005])

<sup>6</sup> according to [DGEMP 2005] ; this is highly contradictory to a number of other national and international studies, for example [CDP 2000] and [Girard 2000]

<sup>7</sup> Traditionally very pro-nuclear, the Communist Party spokesperson in her vote explanation has called the text « insuffisant in research and financing ».

<sup>8</sup> The decrease of the admitted surface temperature of high-level waste from 150°C to 90°C multiplied the storage cost for this waste category by a factor of four.



# 1 Introduction and overview

## Introduction

France hosts, by far, the most extensive nuclear industry infrastructure in the European Union. There are several hundred nuclear installations, including 150 civil nuclear facilities that contain significant quantities of nuclear materials<sup>9</sup>, and almost 200 former uranium mining and milling sites. The decommissioning of nuclear facilities and the long-term management of nuclear wastes in this country represent liabilities in the order of tens of billions of euros. French operators have started only recently, that is in the late 1990s, with a more comprehensive evaluation of the costs involved. However, little information is in the public domain. At the same time the nuclear regulatory context has just changed considerably with new legislation passed on 15 June 2006.

In order to increase the basis and reliability of information for the present study, the main operators AREVA, CEA, EDF and the AREVA subsidiary for nuclear maintenance SOMANU were sent questionnaires including facility specific tables to be filled out. Unfortunately none of the main operators replied positively to the information request and only SOMANU sent back the questionnaire (see Annex 1). The attitude of the main operators seem contrary to the official communication commitments developed by the companies themselves.<sup>10</sup>

## General background on French nuclear policy

After the Second World War, France has embarked on a full-scale nuclear weapons and nuclear energy program. The first generation of gas-graphite reactors came online between 1956 and 1972. But the first large-scale nuclear electricity plan was officially announced in 1974 and justified by the oil crisis in 1973, even though power generation never represented a significant share of French oil consumption<sup>11</sup>.

From the start the French backend strategy was based on the separation of plutonium, first for military, then for civil purposes as well. Plutonium fuelled fast breeder reactors were meant to represent a significant share of the nuclear park before the turn of the century. A 250 MW fast breeder reactor was connected to the grid as early as 1973.<sup>12</sup>

As in many other nuclear countries excellence in waste management and decommissioning was not a priority in the first decades of the French nuclear program. The first surface "low level" nuclear waste disposal facility was opened in 1969 adjacent to the La Hague plutonium plant under conditions that would not be authorised today. Decommissioning activities were, until recently, limited to small research reactors and laboratories. No power reactor has been entirely dismantled and the first full scale project, though of a small 70 MW reactor (Brennilis) only, has

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<sup>9</sup> Facility list transmitted to Euratom

<sup>10</sup> for example AREVA's « commitments » include: "Sincere communications and openness to dialogue are hallmarks of our communication programs. Our goal is to provide reliable, pertinent information enabling an objective assessment of our environmental, financial and social performance." (areva.com)

<sup>11</sup> <13% of the French oil consumption went into electricity generation in 1973

<sup>12</sup> Phenix in Marcoule, now the oldest French nuclear power plant in operation.

experienced cost overruns that led the operator to multiply the decommissioning provisions by a factor of 20.

Following a number of reviews by the nuclear safety authorities and in particular a critical report by the French Court of Accounts in January 2005 and requests by the European Commission, the financing scheme for waste and decommissioning is in the course of undergoing profound change. The approach is basically being modified from delayed to immediate dismantling and from internal integrated to – at least – internal segregated funds.

While the nuclear operators are financially responsible, until the adoption of the new waste legislation there was no legal obligation in France to build up separate funds for the financing of waste management and decommissioning operations. More recently, in agreement with the public authorities, the operators had started to build up funds that are managed separately and at least partially covered by earmarked assets.

### **The status of the French nuclear program and decommissioning projects**

Today France operates 58 pressurised water reactors that provide over three quarters of the electricity in the country<sup>13</sup>, one small fast breeder reactor and a full range of fuel chain facilities, from uranium conversion to spent fuel reprocessing. Numerous uranium mines<sup>14</sup> and a number of uranium mills have been operating in France until a few years ago. The last uranium mine in France has been shut down permanently in May 2001. Most of them are considered decommissioned and cleaned up. The precise state of decommissioning and the quality of clean-up and remediation is difficult to evaluate. IRSN (Institut de radioprotection et de sûreté nucléaire) felt that it was beyond the scope of the first phase of its large-scale uranium mining inventory project [IRSN 2004].

The French Government also considers that: “However, the steps taken so far do not give a sufficiently clear picture of the real situation owing to a lack of investigations into the real impact of mining operations. It was in order to remedy this situation that the Directorate for Regional Action on Quality and Industrial Safety (regulatory authority with responsibility for mines) took part in a study entrusted to the IRSN by the Directorate for the Prevention of Pollution and Risks (regulatory authority with responsibility for ICPEs) in 2002. The purpose of this study, called MIMAUSA (history and impact of uranium mines: summary and archives) was initially to inventory knowledge of the existing situation by collecting data for each site and secondly to conduct specific studies designed to supplement the available information through additional investigations. This second point could lead to proposals for changes to the management and surveillance arrangements for the sites concerned.” [ASN 2005]

Considering the vast amounts of nuclear wastes involved – about 50 million tons or 33 million m<sup>3</sup> of tailings – and the potential significant impact on remediation costs, an

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<sup>13</sup> However, nuclear power corresponds only to 17.5% of final energy in France in 2005, fossil fuels providing 71%.

<sup>14</sup> In 2004 the IRSN (Institut de Radioprotection et de Sûreté Nucléaire), in a first attempt to provide a complete inventory, has identified some 180 sites distributed over 25 departments [IRSN 2004].

independent assessment of the current state of the former uranium mining sites in France would be highly recommendable. The IRSN study represents an appropriate first step in that direction. In addition, in June 2006, the Ministers for Industry, Ecology and Health have mandated Annie Sugier, radiation protection expert at IRSN, to constitute a pluralist group in order « to analyse the problems of the former uranium facilities of AREVA NC (COGEMA) in the department of Haute Vienne ».<sup>15</sup>

29/07/2006 - Mme Annie Sugier, spécialiste de la radioprotection à l'IRSN, a reçu mission des Ministres chargés de la santé, l'écologie et de l'industrie de constituer, puis de présider un groupe d'expertise pluraliste (GEP) dont l'objet sera d'analyser la problématique des anciennes exploitations uranifères de AREVA NC (COGEMA) en Haute Vienne (communiqué [http://www.ecologie.gouv.fr/article.php3?id\\_article=6009](http://www.ecologie.gouv.fr/article.php3?id_article=6009))

A number of mainly CEA operated research reactors and laboratories have been shut down and dismantled (see table 2b).

A first generation of nuclear power reactors has been shut down. These include nine gas-graphite reactors that have also partially been used for the production of weapons grade plutonium, one small heavy water reactor (Brennilis/Mont d'Arrée, 75 MWe), one small light water reactor (Chooz-A) and one large fast breeder reactor (Superphénix).

**Brennilis** is currently probably the most advanced power reactor decommissioning project in France. Operated between 1966 and 1985, the license for the partial decommissioning has been signed on 31 October 1996. This authorisation permitted the creation on-site of an interim storage facility for the wastes stemming from the dismantling operations. In 2003 the operator EDF applied for a license for total decommissioning. The first nuclear building, the solid nuclear waste store (EDS), has been demolished. However, following technical problems with the decommissioning of the effluent treatment plant, the decommissioning activities have been interrupted in 2005 pending the development of a new treatment methodology for the clean-up of the basement of the effluent treatment plant.

The three gas-graphite reactors at **Marcoule** G1 (42 MWth), G2 (43 MWe), G3 (43 MWe), have served for the production of weapons grade plutonium. All three units have been decommissioned to level 2. Further decommissioning heavily depends on the development of a technical solution for the management of large quantities of contaminated graphite that is stored in the reactor buildings.

The three shut-down gas-graphite reactors of the **Chinon** nuclear power plant, A1 (80 MWe), A2 (230 MWe) and A3 (500 MWe), have received a partial decommissioning license respectively on 11 October 1982, 7 February 1991 and 27 August 1996. The interim storage of decommissioning waste has been authorised. The demolition of conventional buildings has started in 2005 while radioactive waste continues to be evacuated from the site.

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<sup>15</sup> see [www.ecologie.gouv.fr/article.php3?id\\_article=6009](http://www.ecologie.gouv.fr/article.php3?id_article=6009)

The final shutdown of the two gas-graphite reactors at **Saint-Laurent-des-Eaux** A1 (500 MWe) and A2 (530 MWe) has been signed on 11 April 1994. In 2005 EDF has started sampling operations in graphite and concrete casing in order to consolidate the radiological inventory.

The final shutdown of **Bugey-1** was authorised on 30 August 1996. Conditioning of the graphite sleeves was finished in 2005 and the dismantling of the CO<sub>2</sub> treatment facilities has started in May 2005. In October 2005 EDF has filed a request for complete decommissioning.

The **Chooz-A** plant (320 MWe), the first pressurised water reactor in France, has received on 27 October 2004 the authorisation to extend the timeframe for partial decommissioning by three years and to upgrade certain facilities in view of complete decommissioning.

The **Superphénix** fast breeder reactor at Creys-Malville (1,242 MWe) has been authorised to proceed with the final shutdown and the first steps towards decommissioning on 30 December 1998. The fuel has been discharged and transferred to the storage facility APEC on the site. The turbine hall has been emptied. On 20 March 2006 the operator has been licensed to proceed with various steps necessary for the complete dismantling of the plant.

Besides the power reactors, operated by EDF, there are hundreds of other individual nuclear facilities in France that contain a significant inventory of radioactive and nuclear materials. These reach from research laboratories to final repositories of radioactive waste. While most of the research facilities (reactors, hot cells, laboratories, etc) are operated by the CEA (Commissariat à l'énergie atomique), most of the commercial industrial facilities (uranium conversion and enrichment, uranium and plutonium fuel fabrication, reprocessing, etc.) are operated by AREVA.

### **Facilities with particular interest from a decommissioning funding point of view**

Table 1 identifies a number of nuclear facilities selected by the author in view of an installation specific analysis. The main selection criteria were either to identify a typical reference case for a series of facilities (for example, one 900 MW reactor), facilities most significant from a backend point of view (large plutonium facilities) or in the course of decommissioning (first generation reactors).

The most significant nuclear installations in France with regard to decommissioning scope and costs are the large plutonium separation plants UP1 (Marcoule), UP2-400, UP2-800 and UP3 (La Hague) and associated facilities as well as the plutonium fuel fabrication plants ATPu (Cadarache) and MELOX (Marcoule). Plutonium contaminated facilities need particular attention and their decommissioning is particularly problematic. Plutonium is a powerful alpha emitter that is highly radiotoxic and difficult to monitor. Microgramme quantities incorporated in the human body, particularly in the lungs, can provoke cancer. Large plutonium plants process several metric tons of plutonium every year. A single facility can cumulate kilogram quantities stuck to inner walls of tubes, machine parts, containers, glove boxes

Table 1a Overview on nuclear installations in France

Nuclear facility	Short name	Country	Kind of facility NPP = nuclear power plant RR = Research reactors	Output <sup>16</sup> - Power in gross MW <sub>el</sub> for NPP, net MW <sub>el</sub> in brackets) - Annual Nominal Capacity for non-reactors	Operational period (grid connection/ commercial operation for NPP)	Operating company <sup>17</sup>	Decommissioning started in year	Decom. stage <sup>18</sup>	To be analysed <sup>19</sup> in WP 1
UP1 (Marcoule)	Secret BNI	F	Reprocessing plant	800 t/a GGR fuel	1958-1997	CEA			x
ATPu (Cadarache) 13115 Saint-Paul-lez-Durance	BNI-32	F	MOX-fuel fabrication plant	40 t/a	1961-2003/2005	COGEMA/CEA			x
AT1 and UP2 (La Hague) 50107 Cherbourg	BNI-33	F	Spent fuel reprocessing plant	AT1: 1 kg/d UP2: 800 t/a GGR fuel	AT1: 1969 -1979 UP2 : 1966-1987 for GGR-fuel (see also BNI-80)	COGEMA	AT1: 1982	- 3	x
STE2 (La Hague) 50107 Cherbourg	BNI-38	F	Effluent and solid waste treatment station	-	1966-	COGEMA			x

<sup>16</sup> In many cases the installed capacity or the nominal capacity has been modified during the operational period. The indicated figures relate to the most recent known situation.

<sup>17</sup> In many cases the operator changed during the operational and/or decommissioning period. The indicated operator is the most recent one known.

<sup>18</sup> The French operators and safety authorities do not use the same terminology as the IAEA Level 1, 2, 3. The classification is therefore based on the more or less subjective appreciation of the author.

<sup>19</sup> The selection indicated is a pre-selection based on the idea to cover each major type of facility (GGR, PWR, FBR, U-fuel fabrication plant, MOX fuel fabrication plant, reprocessing Pu and U stores and labs, etc), the various operators (EDF, COGEMA, CEA, FBFC, SICN, EURODIF, etc) as well as operating and shut-down facilities. It seems particularly important to cover all the large-scale plutonium facilities (reprocessing and MOX fabrication), because the economic implications are significantly larger than for any other plant. The selected NPPs represent the first of each reactor line. The lack of cooperation by the operators has not permitted to follow this list systematically.

Bugey-1 01980 Loyettes	BNI-45	F	NPP	555 (540)	April/July 1972 - May 1994	EDF	Authorisation partial Decom 30.08.96	- 2	x
St-Laurent –des- Eaux A1 and A2 41220 La Ferté- Saint-Cyr	BNI-46	F	NPP	A1: 500 (480) A2: 530 (515)	March/June 1969 and Aug/Nov 1971 – April 1990 and May 1992	EDF	Authorisation partial Decom 11.04.94	- 2	x
Enriched uranium and plutonium store (Cadarache) 13115 Saint-Paul-lez- Durance	BNI-53	F	Enriched uranium and plutonium store	?	Declared in 1968, but probably started operating earlier	CEA			x
LCPu 92265 Fontenay-aux- Roses	BNI-57	F	Plutonium chemistry laboratory	-	1966-1995	CEA		- 1	x
Fuel element fabrication plant 26104 Romans-sur- Isère	BNI-63	F	Fuel element fabrication plant	1,000 fuel elements/a	1962-	FBFC			x
Fessenheim (reactors 1 and 2) 68740 Fessenheim	BNI-75	F	NPP	2 x 920 (880)	Apr 1977/Jan 1978- and Oct 1977/Apr 1978-	EDF			x
UP2-HAO (La Hague) 50107 Cherbourg	BNI-80	F	Spent fuel reprocessing plant	400 t HM/a	1976-?	COGEMA			x
Pellet fabrication facility 38113 Veurey- Voroize	BNI-90	F	Pellet fabrication facility		1977-	SICN			x
Superphénix 38510 Morestel	BNI-91	F	FBR		Jan 1986-Dec 1998	EDF		- 1	x

Georges Besse Plant for Uranium Isotope Separation by Gaseous Diffusion (Eurodif) 26702 Pierrelatte Cedex	BNI-93	F	Uranium enrichment plant	10.8 million SWU/a	1979-	EURODIF PRODUCTION			x
Nuclear fuel fabrication unit 26104 Romans-sur-Isère	BNI-98	F	Nuclear fuel fabrication plant	1,200 t/a of uranium in conversion and 820 t/a of uranium in pellets and assembly	1977-	FBFC			x
Paluel (reactor 1) 76450 Cury-Barville	BNI-103	F	NPP	1,382 (1,330)	June 1984/Dec 1985-	EDF			x
Uranium hexafluoride conversion plant (COMURHEX) 26130 Saint-Paul-Trois-Châteaux	BNI-105	F	UF6 conversion plant	14,000 t/a uranium	1962-	COMURHEX			x
UP3-A (La Hague) 50107 Cherbourg	BNI-116	F	Spent fuel reprocessing plant	1,000 tHM/a	1990-	COGEMA			x
UP2-800 (La Hague) 50107 Cherbourg	BNI-117	F	Spent fuel reprocessing plant		1994-	COGEMA			x
Chinon A1	BNI-133	F	NPP	80 (70)	June 1963 / Feb 1964 – Apr 1973	EDF	Authorisation partial decom 1982, museum	1	x
Uranium clean-up and recovery facility (Tricastin) 26130 Saint-Paul-Trois-Châteaux	BNI-138	F	Uranium clean-up and recovery facility	?	1970s?	SOCATRI			x
Nuclear maintenance facility (SOMANU) 59600 Maubeuge	BNI-143	F	Nuclear maintenance facility	-	?	SOMANU			x

ATALANTE CEN Valrho Chusclan 30205 Bagnols-sur- Cèze	BNI- 148	F	Actinide R&D Laboratory	-	1992-	CEA			x
MELOX BP 2 - 30200 Chusclan	BNI- 151	F	MOX fuel fabrication plant	145 tHM/a	1995-	COGEMA			x
Chinon A3	BNI- 161	F	NPP	500 (480)	Aug/Aug 1966 – June 1990	EDF	Authorisation partial Decom 27.08.96	- 2	x
Monts d'Arrée EL4 Brennilis 29218 Huelgoat	BNI- 162	F	NPP	75 (70 net)	July 1967 / June 1968 – July 1985	EDF	Level 2 Decom start in 199720 Level 3 Decom Authorisation 9.02.06	- 3	x
Ardennes Chooz-A CNA 08600 Givet	BNI- 163	F	NPP	320 (310)	Apr/Apr 1967 – Oct 1991	EDF	Authorisation partial Decom 19.03.99 (modified 27.10.04)	?	x
Bois Noirs Limouzat (St Priest la Prugne)	BNI-?	F	Uranium mine and mill	1955-1980	COGEMA				x
Bessines	BNI-?	F	Uranium mine and mill	1955-1972	COGEMA				x

<sup>20</sup> Deckert, A., et al., « Radiation protection 114 - Definition of Clearance Levels for the Release of Radioactively Contaminated Buildings and Building Rubble, commissioned by the European Commission, DG Environment, Brenk Systemplanung, Aachen, 5 May 1999



Table 1b Overview on already dismantled nuclear installations in France

Nuclear facility	Short name	Country	Kind of facility NPP = nuclear power plant RR = Research reactors	Output <sup>21</sup> - Power in gross MW <sub>el</sub> for NPP, net MW <sub>el</sub> in brackets) - Annual Nominal Capacity for non-reactors	Operational period (grid connection/ commercial operation for NPP)	Operating company	Decommissioning started in year	Decom. stage <sup>22</sup>	To be analysed in WP 1
NÉRÉIDE FAR*	(ex BNI n° 10)	FR	RR	500 kWth	1960-1981			Dismantled	
TRITON FAR*	(ex BNI n° 10)	FR	RR	6,5 MWth	1959-1982			Dismantled	
ZOÉ FAR*	(ex BNI n° 11)	FR	RR	250 kWth	1948-1975			Confined (Museum)	
MINERVE FAR*	(ex BNI n° 12)	FR	RR	0,1 kWth	1959-1976			Dismantled at FAR, rebuilt at Cadarache	
EL 2 SACLAY	(ex BNI n° 13)	FR	RR	2,8 MWth	1952-1965			Sealed Source	
EL 3 SACLAY	ex BNI n° 14	FR	RR	18 MWth <sup>23</sup>	1957-1979			Partial Dismantling to Level 2, Partial Confinement	
PEGGY CADARACHE	ex BNI n° 23	FR	RR	1 kWth	1961-1975			Dismantled	

<sup>21</sup> In many cases the installed capacity or the nominal capacity has been modified during the operational period. The indicated figures relate to the most recent known situation.

<sup>22</sup> The French operators and safety authorities do not always use the same terminology as the IAEA Level 1, 2, 3. Where not indicated by official sources, the classification is based on the appreciation of the author.

<sup>23</sup> 18 MWe according to the CEA

CÉSAR CADARACHE	ex BNI n° 26	FR	RR	10 kWth	1964-1974			Dismantled	
MARIUS CADARACHE	ex BNI n° 27	FR	RR	0,4 kWth	1960-1983			Dismantled	
LE BOUCHET	ex BNI n° 30	FR	Uranium Mill		1953-1970			Dismantled Level 3 in 1982	
GUEUGNON	ex BNI n° 31	FR	Uranium Mill		? -1980			Dismantled	
SATURNE	ex BNI n° 48	FR	Accelerator		1958-1997			Cleaned up, released with restrictions	
ATTILA** FAR*	57	FR	Pilot Repro. Plant		1966-1975			Dismantled	
BAT 19 FAR*	ex BNI n° 58	FR	Plutonium Metallurgy		1968-1984			Dismantled Level 3 in 1986	
LCAC GRENOBLE	ex BNI n° 60	FR	Fuel Analysis		1968-1984			Dismantled	
ARAC SACLAY	ex BNI n° 81	FR	Fuel Fabrication		1975-1995			Cleaned up	
FBFC PIERRELATTE	ex BNI n° 131	FR	Fuel Fabrication		1983-1998			Cleaned up, released with restrictions	
SNCS OSMANVILLE	ex BNI n° 152	FR	Ionizer		1990-1995			Cleaned up	

## **2 Decommissioning strategies and costs**

### **2.1 Current and past decommissioning activities**

Until the end of the 1990s the reference strategy for the decommissioning of commercial nuclear facilities in France consisted of deferred dismantling activities (30 to 50 years) after discharging of fuel from nuclear reactors or respective operations like the evacuation of nuclear materials from other facilities. Only few and small-scale facilities like a number of small research reactors and laboratory scale facilities have been entirely dismantled so far (see table 1b).

In 2003 the French regulations were modified significantly as to allow for the immediate or slightly deferred dismantling of the facilities.<sup>24</sup> The amendment of the rule was felt necessary also to take into account difficulties that had been encountered to apply existing regulations to non-reactor facilities. EDF had decided on its end already in 2001 to decommission its first generation reactors without an additional deactivation phase.

The French nuclear safety authorities are clearly in favour of immediate dismantling under the condition that a full scale dismantling strategy is available prior to the start of the operations. The strategy is elaborated by the operator but has to be authorised by the safety authorities not only from their technical point of view but also on the level of their financial feasibility.<sup>25</sup> The position of the safety authorities was instrumental in the shift from deferred to immediate dismantling as the reference strategy.

Dismantling operations can take more than a decade in case of more complex nuclear facilities, often after several decades of operation. The safety authorities consider that the risk of the loss of memory on the conception and the operation is “very significant”<sup>26</sup>. This is one of the key reasons why the immediate dismantling approach has been adopted in France.

The safety authorities specifically request in most of the cases the development of means to preserve the memory of the past presence of a nuclear facility on a given site and to restrict the scope of its use. This makes it difficult or impossible to apply the level 3 as defined by the IAEA.

### **2.2 The Licensing Procedures**

The nuclear operator has to transmit at least six months prior to the planned final shutdown of a nuclear facility a formal request to stop the operation of the facility together with a precise plan for the various decommissioning stages. The document

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<sup>24</sup> ASN, DGSNR, « Procédures réglementaires relatives au démantèlement des installations nucléaires de base », Révision de la note SIN/PARIS 16310/90 du 9 novembre 1990, DGSNR/SD3/N°/0095/2003, Fontenay aux Roses, letter dated 17 February 2003, Note n° SD3-DEM-01, Indice 1 du 3 February 2003 (see Annex 8)

<sup>25</sup> However, in practice human resources to do so remain limited within the Safety Authorities.

<sup>26</sup> Autorité de sûreté, DGSNR, « Rapport Annuel 2005 », p.414

has to cover technical as well as organisational issues like the management of human resources but no financial issues like precise estimates of decommissioning costs or provisions. The operator has to demonstrate in a safety analysis that at all times the safety margin is assured. The safety authorities have to be kept updated of the advances and potential changes in the situation of nuclear and radiological safety.

In order to avoid unnecessary fractioning of the various decommissioning phases the safety authority wishes to dispose of a precise outline of the entire process from the operational to the target state of decommissioning. After analysis and potential additional requests, the entire process is licensed by a single decree<sup>27</sup>. The licensing decree is published without prior public enquiry, unless the decommissioning is coupled with the creation of a new Basic Nuclear Installation (BNI) or if the risk during the decommissioning phase is considered significantly greater than during the operational phase.

The dossier requesting the authorisation to shut down and dismantle a nuclear facility transmitted by the operator to the safety authorities must contain a detailed study on the expected waste types, their physical, chemical and radiological characteristics and quantities. The waste conditioning and transport packaging has to be identified.

Since the modalities can vary depending on the evolution of the decommissioning all key safety and waste management parameters have to be updated regularly.

The regulation distinguishes two possible cases as outcome of dismantling operations:

- 1) Only conventional wastes remain on the site. In this case, the operator can request the declassification (déclassement) and the facility can be taken off the list of Basic Nuclear Installations.
- 2) After the dismantling procedures radioactive wastes remain on site. In this case, depending on the remaining level of radiation,
  - if the classification BNI is justified, the partial declassification can be requested, allowing for the restriction to a parameter covering the radioactive waste storage.
  - If the classification BNI is not justified, the entire declassification can be requested resulting in a licensing request as Installation Classified for the Protection of the Environment (ICPE)<sup>28</sup>. The ICPE regulation provides for a specific licensing and surveillance procedure for potentially hazardous facilities.

The declassification request must contain an updated Environmental Impact Assessment (EIA). The analysis of the EIA shall provide the basis for the decision by the safety authorities to, yes or no, impose restrictions on the future use of the site.

The EIA must be published and accessible to the general public in the case (the most frequent) that there is no public enquiry.

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<sup>27</sup> The decree is taken on the basis of article 6 ter of the decree on nuclear installations dated 11 December 1963, consolidated on 21 March 2006

<sup>28</sup> Installations Classées pour la Protection de l'Environnement (ICPE)

The regulation explicitly envisages significant changes of the analysis during the decommissioning process and does not exclude to entirely redo the licensing procedure, in case the safety or other forecasted conditions did not materialise and considerably change the potential impact of the operation.

The regulation that impacts on cost estimates for radioactive waste management has considerably changed over the last few years. On 31 December 1999, a ministerial order was passed that stipulates the request for all waste producers to provide a “waste study” (étude déchets).<sup>29</sup> In the study the waste producers has to outline precise targets for the reduction of volume and toxicity of the waste as well as the means to favour reuse and processing in view of final disposal. The producer has also to define the steps leading to the respective objectives. “The operator carries the responsibility for the waste generated in his installations. He guarantees the monitoring of the waste along the waste management streams until their elimination.” (Art. 20)

The operator produces a synthetic document that has to be approved by the safety authorities. It comprises:

- a zoning map identifying the parts of the installation generating radioactive wastes;
- for each type of waste (nuclear or conventional):
  - the description of the mode of waste generation;
  - the waste characterisation and an estimate of the annual quantities generated;
  - the description of recycle and reuse operations;
  - the description of pre-treatment and processing operations;
  - the description of interim storage and transport mode;
  - the description of waste elimination streams.

Any notable evolution or modification of the scheme presented has to be submitted and approved by the safety authorities.

The 2003 regulation does not mention the term finances. However, the partial privatisation of AREVA and EDF have led the safety authorities to pay particular attention to the issue. In its Annual Report 2005, the DGSNR has reiterated a number of recommendations:

- It would be useful, inspired by the best practices of the OECD countries, to study the means to secure the funds attributed to decommissioning and waste management;
- The financial information of the companies must be improved, in particular by covering more detail on the structure of future costs and on the evaluation of the costs of each category of operation indicating the scenarios on which they are based and by supplying as well the gross value as the discounted value of the respective costs.<sup>30</sup>

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<sup>29</sup> Arrêté du 31 décembre 1999 fixant la réglementation technique générale destinée à prévenir et limiter les nuisances et les risques externes résultant de l'exploitation des installations nucléaires de base

<sup>30</sup> Autorité de sûreté nucléaire, DGSNR, « Rapport Annuel 2005 », Paris, 2006, p. 416

The Nuclear Transparency and Security Law<sup>31</sup> that was passed on 1 June 2006 stipulates that the operator has to transmit an annual report specifying “nature and quantity of waste stored on site as well as the measures taken in order to limit the volume and the effect on health and environment, in particular on soil land water.” The Law explicitly requires the operator to transmit the “general decommissioning principles” prior to the licensing of a basic nuclear installation (BNI). Furthermore the Law states: “The authorisation takes into account the technical and financial capacities of the operator that must allow him to carry through his project with respect to these interests, in particular in order to cover the costs for the decommissioning of the installation and the remediation (remise en état), surveillance and maintenance of the implantation site or, in the case of radioactive waste storage sites, in order to cover the expenditures of final shut-down, maintenance and surveillance”.

### 2.3 Spent Fuel and Nuclear Waste Management in France

Historically based on the military reprocessing activities, the French nuclear industry has built up an entire plutonium fuel economy. The original military “Plutonium Factory” (usine de plutonium) UP1 at Marcoule processed first only military and then also civil fuels. The second plant UP2-400 was financed for half of the cost by the military budget of the CEA and for half by the civil budget. The plant also processed civil and military fuels.

In view of the then expected large-scale introduction of fast breeder reactors, the French industry invested in two commercial reprocessing plants, UP2-800 and UP3, each with 850 t/a capacity at La Hague. The licensed capacity was later increased to 1,000 t/a each but limited to 1,700 t/a for the two plants combined. Most of the investment cost of the UP3 plant was covered under cost-plus-fee contracts by foreign reprocessing clients.

The choice of the reprocessing option had considerable impact on the definition of the current waste management scheme in France. A non-negligible share of low-level waste stemming from reprocessing operations is actually discharged into the environment in liquid and gaseous form.

In 1969 a “low and medium level” waste final disposal site, the Centre de Stockage de la Manche (CSM) was opened up adjacent to the La Hague reprocessing plant and operated until 1994 by the CEA. The site, now under surveillance by the National radioactive waste management agency ANDRA, contains over 527,000 t of radioactive waste and hundreds of tons of heavy metals. In particular in the first years of operation characterisation, control and surveillance according to precise technical specifications did not exist. Therefore, the precise content is not really known. Only by the middle of the 1980s a limitation of alpha emitters was clearly established and had to be met by waste producers. But even then control was limited, including for technical reasons.

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<sup>31</sup> *Loi relative à la transparence et à la sécurité en matière nucléaire*

After closure the site was covered with a multi-layer cover that is supposed to avoid the intrusion of water. In February 2003 the site officially entered the surveillance phase.<sup>32</sup> By 2009 ANDRA has to submit a report to the safety authorities, including the design of a potential application of a new cover that would have a quasi-permanent character. After the decision on the future cover design ANDRA has to report back on the evolution of the site characteristics and the environment every 10 years.

Problems identified in the past include the leaking of tritium into groundwater. A recent report by an independent laboratory<sup>33</sup> confirms the persistence of tritium in all of the streams around the storage site. Groundwater contamination attains maximum levels of close to 200,000 Bq/l.

## 2.4 Foreign Wastes

Independent experts have repeatedly asked for the retrieval of the radioactive waste and the clean-up of the CSM site. One of the reasons is the fact that a significant amount of the waste (around 10%) are foreign wastes while the storage of foreign nuclear waste is explicitly prohibited by law. The costs of the potential retrieval of half a million tons of waste, or at least part of it, from the site and subsequent clean-up have not been estimated. ANDRA argues that the cost and risks of the retrieval would be superior to the risk of the site under the current conditions.<sup>34</sup>

In addition AREVA recently lost a legal case against Greenpeace France that might have far reaching consequences, since it defines spent fuel as waste in the sense of the Environment Code and therefore confirms the prohibition to store foreign spent fuel on French territory beyond the time period necessary for its reprocessing.<sup>35</sup> De facto, this renders illegal the storage of a number of foreign materials including not only spent fuel but also, for example, MOX fabrication waste from Germany.

AREVA has been sending back to its foreign reprocessing clients only part of the high level waste. No intermediate and low level wastes have been sent back. AREVA

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<sup>32</sup> Décret n° 2003-30 du 10 janvier 2003 autorisant l'Agence nationale pour la gestion des déchets radioactifs (ANDRA) à modifier, pour passage en phase de surveillance, le centre de stockage de déchets radioactifs de la Manche (installation nucléaire de base n° 66), situé sur le territoire de la commune de Digulleville (Manche), see <http://www.legifrance.gouv.fr/WAspad/UnTexteDeJorf?numjo=INDI0200345D>

<sup>33</sup> Association pour le Contrôle de la Radioactivité dans l'Ouest (ACRO), *Gestion des déchets radioactifs : les leçons du Centre de Stockage de la Manche (CSM)*, commissioned by Greenpeace France, 22 May 2006

<sup>34</sup> <http://www.andra.fr/dechets-radioactifs/radioactif.htm>

<sup>35</sup> In a judgement in favour of Greenpeace France, dated 5 December 2005, the French Annulment Court, the highest French civil jurisdiction, condemned AREVA for illegal storage of Australian spent fuel. The Court states that:

- Spent nuclear fuel is waste in the common sense of law. The Court says that the fuel "cannot be considered as a product obtained at an intermediary stage of a transformation process and that the only qualification which can apply is that of waste in the sense of the Article L. 541-1 II of the French Environment Code."

- And, as a consequence, the « Loi Bataille » of 1991 forbidding any storage of foreign nuclear waste in France apart from those due to technical delays of reprocessing is applying for the cooling period of spent nuclear fuel. In concrete terms, foreign clients of Cogema cannot send their spent fuels for cooling in La Hague pools. (see [http://www.greenpeace.fr/stop-plutonium/en/20051208\\_en.php3](http://www.greenpeace.fr/stop-plutonium/en/20051208_en.php3))

argues that it sends back equivalent waste. A point of view that has been rejected by independent experts and environmental groups. Taking into account the planned shipments of reprocessing wastes to foreign AREVA NC clients until 2011, an independent expert has calculated that the return rate per waste category. Table 2 shows that the volumes that are returned under the polluter-pays principle are far from matching calculated volumes. The full implementation of the New Waste Law that, just as the previous legislation, clearly prohibits the storage of foreign wastes on French soil beyond the delay technically indispensable for reprocessing, would have unknown but large effects on waste management costs.

Table 2 Share of Foreign Reprocessing Waste to be Returned to Foreign Customers<sup>36</sup>

Waste Category	Planned by AREVA NC (in m <sup>3</sup> )	Estimate according to data by ANDRA/AREVA NC (in m <sup>3</sup> )	Return Rate
<b>C (HLW)</b>	1,040	1,365	<b>76,2 %</b>
<b>B (ILW)</b>	1,780	13,251	<b>13,4 %</b>
<b>A (LLW)</b>	0	70,047	<b>0 %</b>

In addition, AREVA's « mode opératoire » provides the operator with a “management flexibility that has been contested by EDF that estimates to have been disadvantaged in favour of the foreign client electricity companies.” [CDC 2005]<sup>37</sup>

In 1992 the National radioactive waste management agency ANDRA started up the operation of a second final disposal site for short-lived low and intermediate level wastes, the Centre de Stockage de l'Aube (CSA) at Soulaines. By the end of 2005 over 182,000 m<sup>3</sup> of waste were already stored at this facility that is designed to hold a total of about one million m<sup>3</sup> of radioactive waste.

As the only nuclear country in the world so far France has decided to establish a specific category for “very low level waste” with a dedicated final disposal concept. In 2004 a VLLW disposal facility with a total capacity of 650,000 m<sup>3</sup> (750,000 t) was opened at Morvilliers, also located in the Aube Department. The site is specifically designed to receive wastes from the decommissioning of the French nuclear facilities that are stemming from contaminated areas but are below levels that would justify the disposal as short lived low or intermediate level wastes. The concept seems exemplary when it comes to avoid the risks inherent to policies based on exemption levels.<sup>38</sup>

<sup>36</sup> André Guillemette, *Problématique des volumes de déchets A, C et B issus du retraitement des déchets radioactifs « importés » et devant être réexpédiés dans leur pays d'origine après retraitement*, 25 juin 2006

<sup>37</sup> The heat output of the waste determines the interim storage time necessary prior to final disposal or the need for additional disposal space in a final repository. Both aspects have obvious cost implications.

<sup>38</sup> The implementation of exemption levels presupposes a high degree of confidence in measuring capacity in order to avoid potential severe contamination of consumer goods by accidental introduction of contaminated materials into an uncontrolled industrial environment.



Table 3 Waste classification and final storage options in France

half-life activity level	very short lived (half-life < 100 days)	short-lived (half-life < 30 years)	long-lived
very low level (VLLW)	management by radioactive decay	dedicated surface repository (Morvilliers repository) recycling technologies	
low level (LLW)		surface disposal (Aube repository) except tritiated waste, sealed sources (under study)	dedicated subsurface repositories under study
intermediate level (ILW)			technologies under study under article L.542 of the Environment Code (law of 30 December 1991)
high level (HLW)		technologies under study under article L.542 of the Environment Code (law of 30 December 1991)	

Source: ASN, 2005

The national waste management agency ANDRA has recently published the second edition of the national radioactive waste inventory [ANDRA 2006]. This is a very useful tool in order to provide an overview of the quantity and quality of radioactive wastes scattered across the French territory. Not including uranium mining, ANDRA identified about 900 sites containing radioactive substances including the following civil nuclear industry sites: 25 front end, 21 for power production, 3 backend, 5 waste treatment or maintenance, 7 research centers and 26 storage sites. Two sites, La Hague and Marcoule, host over 90% of the entire radioactive inventory.

La Hague and Marcoule contain the largest share of the spent fuel, the separated plutonium as well as large quantities of liquid and vitrified high level waste and various types of intermediate and low level radioactive wastes. A significant share of these wastes remains unconditioned. Alpha contaminated sludge stored in a number of silos, for example, represents a difficult challenge. Conditioning techniques have been under research and development for decades. ANDRA also notes that often waste that had been conditioned between the 1950s and the 1970s has to be reconditioned in view of changed standards. This is an aspect that has to be taken into account in view of future cost evaluations.

France has not yet developed any final disposal sites for long-lived intermediate and high-level radioactive wastes. A research laboratory is under construction in Bure, in the department of Meuse, which could eventually be turned into a final disposal facility. Since the start of the Bure project in 1999 the work is already over two years behind schedule and the costs have turned out more than twice the original estimate of € 60.6 million (€2003). [CDC 2005]

## 2.5 Expected duration of decommissioning activities

EDF's projected level 2 decommissioning program for its first generation power reactors and the fast breeder Creys-Malville stretches out until 2026.

The precise decommissioning schedule also depends on the safety conditions at the various sites. In some cases the deterioration turned out to be of unexpected amplitude and the safety authorities insist on precise rescheduling taking into account the modified circumstances.

In June 2004, the French safety authorities considered that:

- the decommissioning of Chinon-A1 might have to be carried out earlier than anticipated considering that the last safety assessment has been carried out in 1987 and the start-up of active decommissioning was not foreseen until 2017;
- in the case of Bugey-1, Saint-Laurent-A1 and -A2 about 2,000 t of graphite are situated some 20 m above the encasement and the heat exchangers; the state internal structures is not well known and in case of the collapse inside the encasement "the explosion risk of graphite dust cannot be entirely excluded at the current state of studies".<sup>39</sup>

The CEA considers that in the case of reactors the delay before decommissioning allows for the decay of shorter lived isotopes while in the case of "fuel cycle" facilities contaminated by long lived isotopes like plutonium a few decades would not make a difference. The former CEA director for waste management and clean-up, Robert Lallement, severely criticizes a recent OCED report on decommissioning [OECD, 2003]. Concerning the time between shut-down and end of decommissioning operations, the CEA considers the 40 year figure provided by the OECD study "bizarre", since it would "not reflect field experience". Some operators would wish to wait 30 years and then do the entire decommissioning job within 10 years while others would wish to spread out the work over the 40-year period. Lallement states: "Curiously the OECD report indicates that the costs of both strategies are equivalent, which is difficult to believe".<sup>40</sup>

Lallement considers that the general tendency of nuclear operators would rather be to wait, let radioactivity decay and "normalise the discussions with the safety authorities without engaging large expenses". On the other hand, there would be an "antagonist tendency to go fast and avoid drifting costs that could stem from the risk of higher waste management costs and regulatory constraints that could lead to increased labour costs (not to forget media and political constraints)".<sup>41</sup>

The CEA considers four decommissioning steps, excluding spent fuel management:

- clean-up (assainissement);
- dismantling;
- waste management;

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<sup>39</sup> ASN/DGSNR, Letter to EDF, Directeur de la Branche Energie, dated 28 June 2004

<sup>40</sup> Robert Lallement, *Démantèlement des installations nucléaires : les voies de la maîtrise industrielle*, RGN, Oct-Nov 2004

<sup>41</sup> *ibidem*

- site remediation.

Following the experience of delays and interruptions of dismantling operations because of lacking waste management schemes, CEA's Lallement estimates that "priorities are now clear. Before decommissioning one needs to create all specific waste disposal facilities and the corresponding waste processing technologies."<sup>42</sup>

## 2.6 Responsibilities for decommissioning management and costs

In France the nuclear operator is clearly responsible for decommissioning and waste management and the coverage of associated costs. The basic principles of the French Environment Code include "the 'polluter pays' principle, according to which the costs resulting from preventive measures, reduction and fight against pollution have to be covered by the polluter" (Art. L.110-1.-II). These principles govern all waste management schemes in France and explicitly include radioactive wastes.<sup>43</sup>

The waste producers' responsibility does not end with the transfer of the waste to a storage or even disposal site. The Second French Report under the Convention on the Safety of Spent Fuel and on the Safety of Radioactive Waste Management [ASN, 2005] states: "The fact that a producer of radioactive waste has transferred its waste to a storage facility or repository belonging to ANDRA does not mean that it is no longer financially responsible. The producers of the waste must pursue an objective of minimising the volume and activity of their waste, upstream during the design and operation of the facilities and downstream during management of the waste. The quality of the conditioning and packaging must also be guaranteed. Monitoring compliance with these objectives is facilitated by the fact that the cost of waste treatment naturally encourages the producers to attempt to minimise the quantities. As part of the process to approve the BNI [Basic Nuclear Installation] waste surveys, the ASN checks that the operator does all to comply with this objective."

However, as stated by the safety authorities: "There is a clear need for a general framework for consistent management of all radioactive waste, regardless of the producer, in order to guarantee its safe management and the associated financing, in particular by defining the relevant priorities." [ASN, 2005]

One of the basic conditions for the establishment of such a general framework is represented by ANDRA's National Radioactive Waste Inventory [ANDRA 2006]. Beyond the creation of the national inventory, parliamentarians and public authorities felt it necessary to create a National Plan for the Management of Radioactive Waste and Recoverable Materials [PNGDR-MV 2005]. The French Government asked the Nuclear Safety Authorities (ASN) to elaborate a draft version of such a plan and to put it up for a public comment period prior to the discussion of new legislation in 2006. The ASN considers the Plan, at least at this stage, is to be considered a "document of status

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<sup>42</sup> ibidem

<sup>43</sup> The Environment Code under article L.541-1.-I defines the principles governing waste management.

assessment and proposals” that aims to reach “a consensus as large as possible” rather than a formal regulatory instrument.

The Plan is a good example of the increased attention that financing aspects receive in the framework of nuclear decommissioning and waste management issues in France. The very first sentence of the foreword clarified that the guarantee of long term financing is inherent part of the Plan’s goals. Attention is given to the case of unknown or insolvent waste producers. In addition, a waste “owner” might not even be aware of the radioactive character of the waste he is holding. This might be the case in particular for historic wastes, forgotten disposal sites or cases of enhanced natural radiation.

## **2.7 Availability of cost estimates for decommissioning activities**

Detailed facility specific information on decommissioning costs is publicly not available in France. The main operators have also refused to contribute information to the present study. The access to detailed cost estimates might change in the future with the adoption of the Nuclear Transparency and Security Law<sup>44</sup>, that stipulates in Art 2.1 that every person has “the right to be informed about the risks linked to nuclear activities and their impact on health and the safety of people as well as on the environment and the effluents of the facilities”.

The New Waste Law stipulates that the operators of basic nuclear installations build up provisions “in a prudent manner, for the costs of decommissioning of their installations or for their radioactive waste storage facilities, the final shut down, maintenance and surveillance costs”.<sup>45</sup> However, it is not defined what the term “prudent” stands for and how these evaluations would be controlled. A future implementation decree might further specify details.

For some areas of waste management there is ample practical experience. In the case of low-level-waste disposal, ANDRA is operating final disposal facilities since 1969 and has precise knowledge of costs involved. It is obvious that the evolution towards more stringent safety standards did have an impact on costs. The prices practiced by ANDRA would not be the same for the Soulaïnes and Morvilliers sites if compared with the first site at La Hague.

A significant cost component is the adequate characterisation of the waste. In the case of the absence of an operational waste management stream, non-negligible interim storage costs, often for decades long periods, have to be added. A typical example of the problems is the case of Marcoule (see further down).

### **EDF’s first generation reactors and Superphenix**

There are no detailed cost allocation overviews publicly available for the different types of decommissioning activities for different nuclear facilities. However, in January 2001, EDF has created the engineering centre CIDEN (Centre d’Ingénierie Déconstruction et

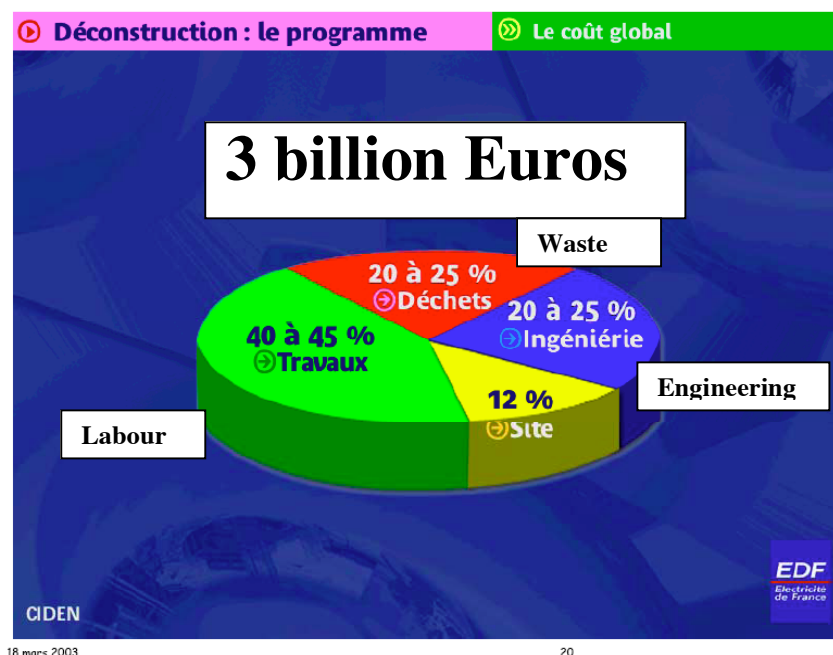
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<sup>44</sup> *Loi relative à la transparence et à la sécurité en matière nucléaire*, dated 13 June 06; published on 14 June 06, [http://www.legifrance.gouv.fr/imagesJOE/2006/0614/joe\\_20060614\\_0136\\_0002.pdf](http://www.legifrance.gouv.fr/imagesJOE/2006/0614/joe_20060614_0136_0002.pdf)

<sup>45</sup> Art. 20, *Loi de programme relatif à la gestion durable des matières et des déchets radioactifs*, 15 June 06, see Annex 7

Environnement), with the specific task to coordinate decommissioning – EDF has chosen the term “deconstruction” rather than dismantling – waste management and site remediation of its shut-down nuclear facilities. CIDEN is also to work on cost estimates. In March 2003 EDF has presented a rough general cost estimate of € 3 billion and of the cost distribution between labour (40-45%), waste management (20-25%), engineering (20-25%) and site remediation (12%) for the decommissioning programme of its first generation reactors and the fast breeder Superphénix (see figure hereunder)<sup>46</sup>. Within a few months, as of the end of 2003, the predicted decommissioning cost for the first generation reactors and Superphenix had risen to over 3.5 billion €. This is not the first time that the figures have been corrected. In 2000 a “complement” of € 1.3 billion, then representing 2.7 times the provisions, was decided for the first generation reactors only. In 2002 an additional € 700 million, then 2.3 times the previous amount, were added to the provisions for the reprocessing of the Superphenix fuel. By the end of 2003 the decommissioning and fuel management of Superphenix alone represented € 2,081 million, € 1,445 million were put aside for decommissioning of the first generation reactors, thus a total of € 3,526 million. [CDC 2005]

Figure 1 EDF First Generation Reactor and Superphenix Decommissioning Program Cost Estimate (as of March 2003)



### The Brennilis Case

The decommissioning of the Brennilis reactor (70 MWe) has absorbed approximately 219 M€ between 1986 and 2001. The estimated additional cost for level 3 decommissioning reaches 263 M€(2002). That is a total of 482 M€, compared to the provisions vacillating between 10 and 30 M€ between 1992 and 1999. After revision of the cost estimate in 1999, the provision was increased by 200 M€.

<sup>46</sup> EDF, *Maîtriser un cycle de vie, La déconstruction des centrales nucléaires*, 18 mars 2003

The first phase of decommissioning attained in 1994 cost some 78 M€, the second about 200 M€ reached in 2005 and the third another estimated 200 M€ to be carried out around 2015.

The original cost estimate was based on a quasi dogma dating from 1979 and stipulated by the PEON<sup>47</sup> Commission that included operators and public authorities, that the decommissioning costs would not exceed 15% of the initial investment. The spectacular miscalculation of costs in the case of Brennilis is seen as stemming from a combination of its pilot project and unique technical characteristics. However, it also seems to illustrate the lack of development of an appropriate cost assessment methodology.

### The Marcoule Case

In 1999 the CEA has estimated the decommissioning and waste management operations at the Marcoule site – essentially the UP1 reprocessing plant and associated facilities and wastes – at over € 6 billion (€2003). The operations are to be spread out until 2040. The cost composition is given as follows<sup>48</sup>:

Table 4 Cost evaluation by type of expense at Marcoule (in M€)

Type of expense	M€2003	Share
Operation	3,159	51.1%
Equipment & Labour	632	10.2%
Engineering & Management	367	5.9%
Storage ANDRA	1,109	17.9%
Risk Margin	919	14.9%
<b>Total</b>	<b>6,186</b>	<b>100.0%</b>

Source: CDC 2005

The figures remain difficult to interpret without a more detailed presentation. The classification of over half of the costs under “Operation” allows to include a wide range of very different positions.

Table 5 Cost evaluation by type of programme at Marcoule (in M€)

Expense by programme	M€2003	Share
Dismantling	2,113	34.2%
Waste conditioning	2,237	36.2%
Final closure	689	11.1%
Transverse	1,147	18.5%
<b>Total</b>	<b>6,186</b>	<b>100.0%</b>

Source: CDC 2005

<sup>47</sup> Commission consultative production d'électricité d'origine nucléaire

<sup>48</sup> The precision of the indicated figures to the million suggests an evaluation capacity that is unrealistic.

The table above shows the relative significance of the waste management costs. A large number of waste types still have to be conditioned or reconditioned (like the over 60,000 bitumen intermediate level waste packages for which reconditioning technologies are under development but still not in operation.) The “transverse” category refers to a part of the costs that are common to all programmes (administration, logistics). Of the total estimated waste management costs only half, about 1,100 € of 2,200 €, are stemming from ANDRA's storage cost estimates (see previous table).

There are multiple factors that can lead and did lead to delays in dismantling and waste conditioning operations and therefore cost overruns. They include “technical difficulties, delays in obtaining administrative authorisations and misunderstandings amongst financing parties”.<sup>49</sup>

The financing of the M€ 1,064 for the first six years of Marcoule decommissioning until the end of 2003 was originally shared between the civil (7.7%) and military (36.7%) departments of the CEA, EDF (39.5%) and COGEMA (16.1%). The remaining expenses were supposed to be financed according to the following key:

CEA military 41%, CEA civil 5.5%, EDF 40% and COGEMA 13.5%.

The evaluation of remaining expenses until 2040 differs considerably between EDF and CEA. Between EDF's “low” scenario and CEA's “high” scenario is a gap of over € 1 billion or 27% (see table hereunder).

Table 6 Evaluation of Marcoule decommissioning costs 1997-2004 (in M € 2003)

<i>Scenario</i>	<b>EDF Estimate</b>		<b>CEA Estimate</b>	
	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>
Spent by 2003	1,064		1,064	
Operations until 2030	2,340	2,790	2,790	
Waste reconditioning	120		120	
Decommissioning post 2030	200		120	800
ILW and HLW storage	1,229		1,229	
<b>Total 2004-2040</b>	3,889	4,339	4,359	4,939
<b>General Total 1997-2040</b>	<b>4,953</b>	<b>5,403</b>	<b>5,423</b>	<b>6,003</b>

It seems that the burden-sharing key was subject to fierce negotiations between the operators but essentially based on respective quantities and burn-up of spent fuel reprocessed. No details are available on the underlying rationale and calculations.

In 2005 ownership of the Marcoule site and the operating license were transferred from COGEMA (AREVA NC as of March 2006) to the CEA and the responsibility for decommissioning was transferred to the CEA in exchange for a lump sum payment of

<sup>49</sup> CDC 2005, p.112

€ 427 million, half of which AREVA paid to the CEA at the end of 2004, with the other half paid in the beginning of 2005. EDF paid a bail out lump sum of € 1,174.5 million.<sup>50</sup> It should be stressed however, that the payments do *not* cover the liabilities for shipment and storage of the respective calculated shares of conditioned waste.

In March 2006 the European Unit of Greenpeace filed a complaint with the DG Competition of the European Commission on the issue of the Marcoule bail out payments. On the basis of information provided by the French government the Commission has decided on 24 May 06 to close the file unless new elements would be brought to its attention within 15 working days. The Greenpeace EU Unit representative who filed the complaint has stated: "Due to the procedural time restrictions, Greenpeace is letting the current complaint lapse. However, we continue to investigate the liabilities situation at Marcoule and will act on new information as and when it comes into our possession".<sup>51</sup> French government representatives have declined to comment on the bail out payments with reference to the ongoing case and the information supplied to the European Commission. However, the information submitted by France is usually classified and has not been made available, neither to the plaintiff nor to the author.

DG Competition has justified to close the file in the following way: "The available information does not support the idea that the level of compensation and / or release of liabilities would have been designed in order to grant the Polluters any economic advantage or an exception from the 'polluter pays' principle. The nuclear waste, for which no final repository exists at present, remains in the charge of the Polluters. The monies paid by the Polluters cover only the dismantling of the fixed installations. Our inquiries also point to the fact that the general reorganization and the payments made have been based on normal economic and organizational reasons and logic. The estimates on liabilities have been in line with usual industry practice. The procedure has been transparent. The sums paid by EDF and COGEMA to CEA cover the monetary value of all liabilities concerned as actualised to the date of payment. »

The argumentation of DG Competition to close the file seems surprising. While the shipment and storage of conditioned long-lived intermediate and high-level waste is excluded from the bailout, according to available information, the waste conditioning itself is not. Considering the fact that a plutonium complex of the size of Marcoule has never been dismantled and that reconditioning techniques for existing waste packages (in particular the over 60,000 bitumen waste packages mentioned above) are only under development, it seems difficult to assume that "estimates on liabilities have been in line with usual industry practice".

AREVA specifies in its annual report that "a total of 300 people were transferred from AREVA NC to the CEA for site support. AREVA NC, as the CEA's leading industrial

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<sup>50</sup> CDC 2006, p.107

<sup>51</sup> Personal Communication, Mark Johnston, e-mail, 18 June 2006



partner, will be responsible for managing and implementing cleanup operations under a multiyear agreement currently under negotiation for the 2005-2010 period.<sup>52</sup>

The Court of Accounts states: "It is surprising that a nuclear operator can be discharged of the decommissioning responsibility while it is international consensus, as noted by the [safety authority] ASN, that the decommissioning remains as much as possible with the operator of the facility while it was active". [CDC 2006]

One should add that it is also surprising that the same former operator AREVA NC will be the principal client for management and implementation of the clean-up work. It is obvious that the interests of EDF and CEA are not identical. While the CEA is a majority shareholder of the main decommissioning contractor AREVA NC, for EDF decommissioning is a net expense. May be here is one of the reasons for the large differences in the cost evaluations between CEA and EDF.

The ongoing dismantling activities at Marcoule, which currently represents the world's largest dismantling project, are to provide useful reference for the future dismantling of the La Hague facilities. The intermingling of civil and military activities of very different nature – military plutonium and tritium production and separation, joint civil military uses of reactors and plutonium facilities, fuel fabrication, etc. – lead not only to a complex technical situation but also to a financial context that is difficult to apprehend. Marcoule also serves as storage site for a large variety of nuclear and radioactive wastes and materials. Some materials, like the uranium stemming from the reprocessing, are not officially classified as waste although they have never been reused in the production of nuclear fuel.<sup>53</sup>

### **The Geological Storage Case**

Between 1996 and 2003, ANDRA's cost estimate for the geological storage of the French long lived intermediate and high level wastes have jumped from less than € 15 billion to between € 16 and € 58 billion depending on the scenario. In the following table Scenario S1a stands for the "all reprocessing" option for spent fuel, currently the official French policy.<sup>54</sup> S1b assumes the continuation of reprocessing of uranium fuel but the direct final disposal of spent MOX fuel. S2 is based on the entire phase out of reprocessing by 2010 and the direct final storage after. *Details of the underlying assumptions are not available.*<sup>55</sup>

In 2005 a working group was set up by Ministry of Industry in order to reassess the final storage costs. It decided to concentrate on the S1a scenario and came up with a cost range between 13.5 and 16.5 billion €. [CDC 2006] The arbitrary decision to leave

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<sup>52</sup> AREVA, Annual Report 2005, April 2006

<sup>53</sup> EDF owns some 3,800 t and the CEA and AREVA some 4,800 t of reprocessed uranium that is stored in the form of uranyl nitrate at the site. In its Annual Report 2005 EDF states:

<sup>54</sup> However, as the Court of Accounts pointed out : « It is not sufficient for a strategy to be announced for it to become reality ». [CDC 2005]

<sup>55</sup> It is worth noting that the overall system costs for the once-through option are generally evaluated as significantly lower than the reprocessing option (see for example [CDP 2000])

out the cost evaluation for the other scenarios does not mean that they do not have to be taken into consideration.

Table 7 Evolution of geological disposal cost estimate (M€2003)

Scenario	Low	High
Estimate 1996	14,704	
Estimate 1998	21,284	
Estimate 2003 <b>Scenario S1a</b>	15,946	24,332
Estimate 2003 <b>Scenario S1b</b>	25,237	41,435
Estimate 2003 <b>Scenario S2</b>	34,670	58,035
Estimate 2005 <b>Scenario S1a</b>	13,500	16,500

Source: ANDRA [CDC 2005], DGEMP Working Group [DGEMP 2005]

The assessment of the quality of the various cost assessments would go far beyond the scope of the present study. However, it is remarkable that the single decision about future spent fuel management has a potential impact of close to € 45 billion on the single cost item final geological disposal.

The “all reprocessing” reference scenario envisages that not only all spent uranium fuel would be reprocessed continuously but also that spent MOX fuel would be reprocessed from 2025 onwards. Curiously, 2025 is the planned closure date for the currently operating reprocessing plants at La Hague. In other words, the scenario would presuppose the building of new reprocessing facilities. However, any new investment costs cannot be identified in the published cost figures.

Another example of a surprisingly large cost driver is the heat input into the final medium and high-level waste disposal facility. The limitation of the admitted surface temperature of the high level waste package at 90°C rather than the previously admitted 150°C led to a multiplication by up to a factor of four of the disposal cost estimate per m<sup>3</sup> between 1996 and 2003.<sup>56</sup> [CDC 2005]

## 2.8 Regulation and control of cost estimates

The regulation for the cost estimates for radioactive waste management has considerably changed over the last few years and has been already described in a previous chapter.

The cost calculations for decommissioning and most of the waste management were essentially carried out by the operators and the national waste management agency. Until the late 1990s the estimates were based on approximate and superficial studies that were often outdated. AREVA, for example, has now indicated it sets an internal goal to update decommissioning cost evaluations at least every six years.

In the case of power reactors, since the 1970s a sort of dogma said the decommissioning cost should represent 15% of the investment cost that is per kW installé, figure put forward by the PEON Commission on never published

<sup>56</sup> from 1.086 M€/m<sup>3</sup> to between 2.467 and 4.404 M€/m<sup>3</sup>

assumptions.<sup>57</sup> It is only between 1996 and 1998 that EDF has carried out a detailed reference study into the decommissioning of the Dampierre site with four 900 MW reactors.<sup>58</sup> The Court of Accounts has qualified this study as “very seriously carried out”. The results would indicate that the order of magnitude would still be within the range of 15% per kW installé: € 249 million for a 900 MW reactor, € 360 million for a 1,300 MW unit and € 387 million for a 1,400 MW plant. In the absence of further detail it is difficult to understand why the size difference of the units should be more cost sensitive than for example the number of units per site.

The most detailed publicly available document on cost estimates in France is an EDF/Framatome decommission cost calculation methodology study under Commission contract [EDF/Framatome 2001]. The project also got support from the Slovakian company VUJE and the Belgian research center SCK-CEN. The objective of the project was to provide:

- Calculation methods and algorithms for the elaboration of cost items;
- Estimated or standard values for the parameters and for the cost factors to be used in the algorithms;
- Financial mechanisms.

The methodology provided was clearly intended “to be a generic one that can be adapted to the specific needs of all interested third parties”. Consequently, it does not provide French facility specific data. However, the project covers in particular:

- A very useful overview of calculation methods and algorithms for a large number of items that make up reactor decommissioning costs;
- Standard values, where applicable, for the items identified;
- The description of financial mechanisms to be applied to the items identified.

The cost differential between immediate and **delayed decommissioning** is surprisingly small, according to some experts. A report commissioned by the French Prime Minister calculated the cumulated difference at less than 15% savings in the case of the level 3 decommissioning delayed by 40 years [CDP 2000], which should be a lot less than the uncertainty attached to the calculations.

In some areas the costs to the operator are clearly established, e.g. when ANDRA bills a specific amount per ton of low or very low level waste transmitted to the ANDRA's disposal sites in Soulaire and Morvilliers.<sup>59</sup> However, in other areas the costs remain highly speculative. The Court of Accounts stated for example that “while, considering the accumulated experience, it cannot be contested that the CEA has the technical

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<sup>57</sup> It has never been justified why decommissioning costs should be represented as percentage of investment cost. In fact, both cost parameters follow rather different development patterns. An obvious reason for that is that decommissioning is taking place several decades after construction.

<sup>58</sup> The author has asked EDF for the transmission of the study but EDF has ignored the request.

<sup>59</sup> In the case of low level waste, the average cost has been estimated by ANDRA at 2,529 €(2002) per m<sup>3</sup> of which 80% are fix costs. [CDC 2005]

capabilities to clean up its centres over the next decades, only the coming years will allow to verify whether it will be able to accomplish the various operations in time and for the costs announced” [CDC 2005].

## **2.9 Control of cost estimates**

The Court of Accounts, at its own initiative, has periodically assessed the operator cost calculations and dismantling and waste management funding policies. However, these assessments are more targeting the financial policy rather than providing public analysis of the cost calculations themselves.

The nuclear safety authorities have also recently started to increased attention to the cost calculations by the operator in order to analyse whether the basis is provided for a long-term safe management of dismantling and waste management operations. However, they do not have the competence nor the manpower to do detailed cost estimates.

The statutory auditors also play a surveillance role. The CEA's auditors have for example repeatedly attracted attention to the lack of concordance between physical advance of the CEA's decommissioning projects and the financial planning. [CDC 2005].

Table 8 Expected total costs of future decommissioning of nuclear installations in France (in prices of 2004)

Main French nuclear operators	Kind of facility: NPP = nuclear power plant	Years decommissioning activities are expected to take place	Total decommissioning costs estimated [Mio. Euro]	Annuity of estimated decommissioning costs in relation to output over lifetime [ct/kWh for NPP; 4%]	Remarks
EDF	NPPs and waste		48,187		
CEA	Research, fuel cycle and waste		13,211		
AREVA	Fuel cycle and waste		8,258		
SOMANU Maubeuge	Nuclear Maintenance		10		
EDF	NPPs and waste		48,187		

Source: CDC 2006, SOMANU 2006

### 3 Funds and fund management

#### 3.1 New accountancy rules impact on nuclear provisions

Provisions for expenses (provisions pour charges) are supposed to take into account future charges that are defined as to their object but not necessarily to their amount or the precise moment when they will have to be actually disbursed. The obligatory character of dismantling and waste management triggers the operator's obligation to state provisions accordingly in their accounts.

According to the Court of Accounts, in the case of dismantling, the start-up of the facility triggers the obligation, while in the case of back-end obligations they are triggered by the productive activity. [CDC 2005]

This new accountancy regulation that came into force in January 2002<sup>60</sup> changed the basis for the accountancy of provisions in the nuclear sector. As a consequence COGEMA (now AREVA NC) had to provision 100% of the estimated decommissioning charges of Marcoule instead of some 15% corresponding to the approximate share that COGEMA would have had to cover. EDF had to provision the entire expected future cost of its operating nuclear power plants.

The decommissioning assets are subject every year to discounting calculated on the operating life of the installation. As of 2005 the three main nuclear operators in France have opted for a uniform discount level of 3% per year (5% discount rate and 2% inflation) for their backend provisions. In other aspects the situation differs between the various operators. The situation for the main operators AREVA, CEA and EDF are discussed in the following chapter.

As indicated before, the New Waste Law stipulates in article 20 that the operators of basic nuclear installations build up provisions "in a prudent manner, for the costs of decommissioning of their installations or for their radioactive waste storage facilities, the final shut down, maintenance and surveillance costs". In addition the law requires operators to " earmark necessary assets exclusively to cover these provisions". These assets have to be accounted for separately and they have to present a "sufficient degree of security and liquidity in order to serve their objective". Their market value has to be at least as high as the provisions to be covered. The assets are protected by law and nobody, besides the state in the execution of its right to enforce the operators' obligations to decommission their facilities and to manage their spent fuel and radioactive waste can claim any right over the assets.<sup>61</sup> This means that it is aimed at protecting the assets in case of insolvency or bankruptcy of an operator while at the

<sup>60</sup> Règlement n°2000-06 du 7 décembre 2000 du Comité de la réglementation comptable, homologué par arrêté du 17 janvier 2001

<sup>61</sup> Art.20 II of the New Waste Law stipulates: « A l'exception de l'Etat dans l'exercice des pouvoirs dont il dispose pour faire respecter par les exploitants leurs obligations de démantèlement de leurs installations et de gestion de leurs combustibles usés et déchets radioactifs, nul ne peut se prévaloir d'un droit sur les actifs mentionnés au premier alinéa du présent II, y compris sur le fondement du livre VI du code de commerce.»

same time leaving them with the operator who has a so far unclear level of freedom to control and access them.

### 3.1.1 AREVA

The nuclear group AREVA, the world's largest nuclear company, mainly operates fuel "cycle" facilities. AREVA is also the only French company to operate large plutonium facilities that are particularly problematic to decommission and that represent highly uncertain costs. The statutory auditors that have assessed AREVA Group's accounts 2005 have issued the following statement: "Without qualifying our opinion, we draw your attention to the procedures for measuring the end-of-life-cycle assets and liabilities described in Notes 1.18 and 25 to the consolidated financial statements [see annexes 2 and 3]. This measurement, which is based on Management's best estimates (...), is sensitive to the assumptions adopted with regard to estimates, disbursement schedules, discount rates and the outcome of current negotiations with EDF." [AREVA 2006]

AREVA's accounts have switched to IFRS rules in 2005 only. The site-specific provisions as of the end of 2004 are indicated in the following table<sup>62</sup>.

Table 9 COGEMA (now AREVA NC) provisions by site (in M€)

Site	Provisions in 2003 (in M€)			Provisions in 2004 (in M€)		
	Provision	Third Party Share	Cogema Share	Provision	Third Party Share	Cogema Share
La Hague	6 479	4 298	2 181	6 415	4 163	2 252
Marcoule	4 325	3 656	669	158		158
Pierrelatte	239	206	33	189	142	47
Melox	404		404	423		423
Cadarache	149		148	220		220
Eurodif	471		470	492		492
Others	162	30	134	115	3	113
<b>Total</b>	<b>12 229</b>	<b>8 190</b>	<b>4 039</b>	<b>8012</b>	<b>4 308</b>	<b>3 705</b>

Source: COGEMA, in CDC 2005

The table illustrates the overwhelming significance of the plutonium separation plants at La Hague and Marcoule that represent over 88% of total provisions in 2003. If one adds the plutonium fuel factories MELOX and Cadarache, COGEMA's – now AREVA NC's – plutonium activities represent over 92% of the provisions.

As indicated above, in 2005 ownership of the Marcoule site and the operating license were transferred from AREVA NC to the CEA and the responsibility for decommissioning was transferred to the CEA in exchange for a lump sum payment of € 427 million, half of which AREVA paid to the CEA at the end of 2004, with the other

<sup>62</sup> Site-specific end of 2005 figures are not available.

half paid in the beginning of 2005. The spectacular impact on the Marcoule bail-out agreement is translated by a drop in the provisions by over € 4 billion.

The € 158 million in 2004 correspond to the COGEMA waste management share that has not been transferred to the CEA. The large third party share at La Hague corresponds to the awaited participation by EDF.

In 2005, following a reappraisal of the expected operational life-times, AREVA operated a 10-year increase in discounting periods for La Hague and MELOX facilities<sup>63</sup>. According to AREVA's financial statement, "the positive recurring impact of this item on operating income is around €20 million per year. A one-time catch-up gain was recorded in 2005".<sup>64</sup>

Table 10 AREVA provisions by type of liability

	2003	2004		2005	
	<i>Undiscounted value</i>	<i>Undiscounted value</i>	<i>Discounted value</i>	<i>Undiscounted value</i>	<i>Discounted value</i>
<b>Dismantling</b>	8,458	6,814	3,155	7,053	3,262
<i>Incl. third parties</i>	5,231	3,667	1,533		
<b>Waste reconditioning</b>	3,858	1,444	1,177	2,106	1,228
<i>Incl. third parties</i>	2,760	642	482		
<b>Total liabilities</b>	<b>12,316</b>	<b>8,258</b>	<b>4,332</b>	<b>9,159</b>	<b>4,490</b>
<i>Third parties</i>	-7,991	-4,309	-2,015		-2,045
<b>Provision AREVA share</b>	<b>4,325</b>	<b>3,949</b>	<b>2,317</b>		<b>2,444</b>

Sources: CDC 2006, AREVA 2006

The amount of AREVA's reserves at closure of the 2002 accounts were € 3,779 million and in 2003 it was € 3,859 million. A portfolio dedicated to cover these expenses was set up. As of 31 December 2003, the size of the portfolio was such as to cover the total cost to be borne by the group when the dismantling operations fall due. On the basis of a real minimum net performance expected of this portfolio, after inflation and taxes (about 3.5%), the group aims to break even between the cost of the dismantling and waste conditioning work for which it is responsible and the value of this portfolio. The 2002 market value of this portfolio was given as € 1,809 million [ASN 2005], while at the end of 2005 it was € 2,669 million [AREVA 2006].

Financial reserves intended for dismantling and waste management operations are defined jointly with the supervisory Authority and regularly created on a pro-rata time basis until expiry of the investment contracts in the portfolio.

<sup>63</sup> UP2-800 and UP3 at La Hague are now expected to close in 2025 rather than in 2017 and MELOX shall operate until 2027 rather than 2025. The underlying studies are not publicly available.

<sup>64</sup> The size of the « one-time catch-up gain » is not transparent in AREVA's financial accounts.



The cost of dismantling of industrial units in the back end of the fuel cycle by AREVA has been estimated, including management of "legacy" waste, at about €4 billion.

AREVA acknowledges "the Group must bear the full or partial cost of nuclear facility decommissioning, mine site reclamation and remediation of plant sites at the end of operations. Provisions have been recorded to cover the estimated costs, but actual costs could be significantly different", that is significantly higher. AREVA considers it « possible that these future obligations and potential expenses or potential additional future liability of a nuclear or environmental nature could have a significant negative impact on the Group's financial position". One of the uncertainties is linked to the potential need for extended storage of wastes attributable to clients, in particular foreign clients. AREVA acknowledges that it may remain "liable if a customer defaults or files for bankruptcy. For waste of foreign origin stored at La Hague, international agreements provide for all waste to be returned to the country of origin, while the provisions of Article L. 542-2 of the French Environmental Code, issued pursuant to the law of 30 December 1991, prohibit final disposal in France of imported radioactive waste. Despite these rules, the Group could be exposed to the risk of having to store this waste. Such a risk, should it materialize, could have a significant negative impact on the Group's financial position. [AREVA 2006]

According to AREVA's Annual Report 2006 as of the end of 2005, the Group's assets earmarked for backend obligations represented €4,843 million, to be compared with obligations representing €4,490 million.

At December 31, 2005, these assets included (see annex 3):

- a financial portfolio representing €2,669 at market value;
- a receivable from CEA representing €123 million;
- future receivables from third parties (mainly EDF's contribution to La Hague decommissioning<sup>65</sup>), representing €2,045 million.

"At 31 December, 2005, 42% of the portfolio was comprised of mutual funds invested in bonds and money market instruments and 58% was invested in European equities through direct investment in publicly traded French companies or through mutual funds invested in European equities.<sup>66</sup> Considering the intrinsic volatility of equity markets, the value of the portfolio could decrease and/or provide a return insufficient to fund the Group's end-of life-cycle obligations. The Group would have to use other financial resources to fund these obligations, which would result in a significant negative impact on its net income and financial position." [AREVA 2006]

AREVA also notes that it "does not consolidate its dedicated mutual funds on an individual basis, since the company is not involved in their management, which is under the responsibility of first-rate management firms that are independent from the Group. These mutual funds are benchmarked to the MSCI index of large European

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<sup>65</sup> The La Hague plants UP2-800 and UP3 are expected to be shut down in 2025 and decommissioned between 2040 and 2060 [AREVA 2006]

<sup>66</sup> For details on the composition of companies and mutual funds see Annex 2

capitalizations, with strict limits on risk. The funds are regulated by the French stock market authority and therefore subject to regulations governing investment and concentration of risk. Moreover, AREVA complies with the conditions established in the August 2005 interim report of the French National Accounting Board regarding accounting for dedicated mutual fund investments. This method, adopted effective 31 December 2005, shall remain in effect until IFRIC issues an opinion on the French National Accounting Board's interim report. In addition:

- AREVA does not have control over the mutual funds' management firms;
- AREVA does not hold voting rights in the mutual funds;
- the funds do not trade directly or indirectly in financial instruments issued by AREVA;
- none of the financial investments made by the funds are strategic to AREVA;
- AREVA receives no benefit and bears no risk, directly or indirectly, other than those normally associated with investments in mutual funds and in proportion to its holding;
- the funds have no debt or liabilities other than those resulting from normal trading.

Accordingly, the dedicated mutual funds are recognized on the balance sheet under a single heading corresponding to AREVA's share of their net asset value as of the end of the year.

Irrespective of their long-term investment objective, the funds dedicated to financing end-of-life-cycle operations are recognized as available-for-sale securities<sup>67</sup>. Accordingly, the accounting treatment of changes in fair value and lasting impairment measurement and recognition methods are identical to those applicable to directly-held shares."

### 3.1.2 CEA

The situation of the CEA is particularly complicated due to the civil and military nature of its activities. A total of € 13,211 million has been filed as provisions for both sectors, including € 6,435 million for civil and € 6,776 million for military backend activities. The attribution of expenses to either sector is not transparent. Detailed facility related cost figures are not available. The provisions are supposed to cover all of the calculated costs.

In 2001 it was decided to set up a separate internal fund for the civil installations and at the end of 2004 for defense activities. The funds are meant to cover all expenses to be expected for decommissioning and waste management issues.

The level of confidence into cost estimates is highly uncertain and the financing schedule is unclear.

The statutory auditors noted in their comments on the 2004 Annual Report: "We would express a reservation on the following point: The end of cycle reserves entered in the

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<sup>67</sup> under IFRS 39

accounts were based on projections based on estimates and the assessment of the estimated future charges incurred (...). The 2004 financial year has been subject to extensive updating of certain estimates and the setting up of additional control measures. In view of the recent nature of this work, the evaluation of these reserves and the level of writing back entered over the financial year remains to be backed up by a process of reconciliation of the actual expenditure and the level of technical progress achieved and the estimates relating to the dismantling and cleanup programmes. (...)” The auditors explicitly draw attention to notes 2 i) on provisions for ‘Liabilities and charges’ and 14 on ‘Dismantling assets’ “which refer to the uncertainties involved in the evaluation of end-of-cycle costs, particularly as regards the final waste, as well as the amount of the ‘Dismantling assets’ entered under the State, standing at € 3,503 million as at 31 December 2004 which still does not have the benefit of a specific financing schedule” [CEA 2005].<sup>68</sup>

Similar reservations have been emitted by the statutory auditors every year since the civil fund has been put in place in 2001. The Court of Accounts notes also that the financing of the CEA decommissioning and clean-up operations follows “more and more complex rules” [CDC 2006]:

- The civil fund is to cover the costs corresponding to civil installations with the exception of internal labour costs;
- The defense fund finances only the decommissioning of the reprocessing plant at Marcoule and the enrichment plant at Pierrelatte;
- The State contribution, estimated at € 3,503 million at the end of 2004, is to finance the internal labour costs, the other defense related facilities as well as the non-recoverable part of VAT. [CDC 2006].

The CEA has put the annual expenses at € 150 million per year over the last three years 2003-2005 for the civil installations and at € 250 million per year for defense facilities. However, included in the last figure is a depense of € 190 million per year, thus three quarters of the total, for the reprocessing plant UP1 at Marcoule alone.

The principles for the accountancy and management of the CEA funds are as follows:

- individualised operation in the accounts: separation of revenues and expenses for each fund;
- external control by two supervisory committees chaired by a CEA member of the board and open to external experts with a large mission including physico-financial monitoring of the operations, opinions on the budgets and accounts, validation of earmarked assets, monitoring of the assets/liabilities balance sheet;
- Externalised management of the cash-flow under external consulting (AGF AM) for the asset allocation, the selection of the managers and the reporting.

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<sup>68</sup> see Annex 5 for full text of Notes 2 i) and 14

At its creation the civil fund has been fed by financial liquidities and 15% of the AREVA capital of the 79% detained by the CEA. It is also fed annually by a share of the dividends allocated by AREVA to the CEA.<sup>69</sup>

### **3.1.3 EDF**

EDF's provisions for the decommissioning of its nuclear power plants are to cover all the liabilities involved. As stated above, there is no detailed information on facility specific cost assessments publicly available. However, in some specific cases the provisions indicated by EDF seem surprisingly low. For example in the case of the fast breeder reactor Phenix, the discounted costs are indicated with less than € 200 million (undiscounted € 368 million). [CDC 2006]

The tentative schedule for future disbursements is set up by EDF experts who "take into account all known statutory and environmental regulations applicable, together with an uncertainty factor inherent to the fact that payments will only be made in the long term". Estimated disbursements are adjusted to reflect inflation, then discounted.

## **3.2 The case of foreign participations in nuclear facilities**

There are several cases where foreign utilities, in particular Belgian, Swiss and German have taken direct shares in the investment of nuclear power plants in France. On the other hand, EDF has acquired participations in foreign utilities that operate nuclear power plants, in particular in Germany.

According to EDF's Financial Report 2005, « in application of the principle whereby assets and liabilities are not netted when estimating the provisions for risks and expenses, an asset is also recorded in the form of accrued revenues, corresponding to the share of decommissioning costs for the Cattenom 1-2 and Chooz B 1-2 PWR plants to be borne by foreign partners, in proportion to their investment. »

In the case of EDF's shareholding in the German nuclear operator EnBW, a provision is recorded to cover the present value of the decommissioning obligations. For the five EnBW plants (Neckarwestheim-1 and -2, Obrigheim, und Philippsburg-1 und -2), the forecast disbursement schedule and future costs are estimated based on the decommissioning plan drawn up by external consultants, and « take account of all regulatory and environmental regulations known to date in Germany ». The costs are calculated on the assumption of direct decommissioning of the plants. [EDF 2006]

EDF is only progressively building up a dedicated portfolio of assets in order to cover future backend expenses. In September 2005, EDF decided to include in the basis for dedicated assets already closed plants that are in the course of decommissioning, and the share of the provision for last cores corresponding to the reprocessing of fuel and removal and storage of the waste from those plants. Also it was decided to establish 2010 as the target date for earmarked assets covering all provisions concerned. As of

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<sup>69</sup> CEA, Dossier de Presse, 6 June 2006

the end of 2005, according to EDF, the undiscounted value of this portfolio was € 3,377 million and shall reach over € 15 billion by 2010. In order to reach that goal, EDF will increase dedicated assets from a current level of € 300 million per year to € 2.7 billion as of 2006, and to € 2,35 billion per year between 2007 and 2010 (figures in €2005).

### **3.3 ANDRA**

The new nuclear waste bill stipulates the creation of an internal restricted fund by ANDRA for the “financing of construction, operation, final closure, maintenance and surveillance of interim storage and final disposal of intermediate and high level waste built or operated by the Agency”. The operation of the fund will be subject to a distinct accountability in order to distinguish resources and expenditures out of the fund from the Agency’s general accounts. The fund will be fed by the operators’ contributions based on their conventions with the Agency.<sup>70</sup> The law also stipulates that if the “administrative authority” notes that the application of the law are not fulfilled, it can impose on the operator the payment of the funds necessary to cover the costs. However, until the publication of a ministerial decree it remains unclear what governmental branch represents the “administrative authority” and what would be the means to force the operator to pay the sums due.

### **3.4 Audit, review and control systems**

There are some supervisory mechanisms that have been set up voluntarily by the main operators. In the case of AREVA, a special surveillance committee shall provide guidance on the coverage of clean-up and decommissioning liabilities (Cleanup and Decommissioning Fund Monitoring Committee). It comprises representatives of the Ministry of Industry, the Treasury, the CEA and the employees of AREVA NC. The committee’s task is to follow the portfolio of earmarked assets, to evaluate the pluriannual disbursement schedule, the modalities of the constitution, functioning, management and control of the dedicated funds and to consult the financial institutions chosen by companies responsible for fund management.

For all main operators, the statutory auditors play an important role in order to control the financial aspects of the backend liabilities. Auditors have not hesitated in the past to state an explicit reservation concerning uncertainties of financial guarantees, as has been illustrated in the case of the CEA.

In addition, the New Waste Law provides the administrative authority, which remains to be identified, with considerable enforcement power, if the operator does not constitute the funds as required. (Art 20/III): « In case of default of those requirements within the prescribed deadline, the administrative authority may order, subject to a daily penalty,

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<sup>70</sup> Art. 15, *Loi de programme relatif à la gestion durable des matières et des déchets radioactifs*, 15 June 06, see Annex 7

the constitution of the required assets and impose any relevant measure pertaining to their management. » And Art 16 the New Law specifies:

“The administrative authority, upon establishing that the application of the requirements referred to in Article 20 (...) concerning the sustainable management of radioactive materials and waste is likely to be obstructed, may impose upon the operator of a nuclear facility to pay to the fund, with a daily penalty if need be, any required amount in order to cover the charges referred to in Section I of the same Article 20.”

The New Waste Law also foresees the creation of a National Commission for the Evaluation of Decommissioning Costs of Basic Nuclear Installations and the Management of Spent Fuel and Radioactive Wastes.<sup>71</sup> The commission evaluates the control of the aptitude of the provisions and can submit its view to the Government or the Parliament at any time. Every three years it submits to Parliament and High Committee on the Transparency and Information on Nuclear Security<sup>72</sup> an assessment report. The report is public.

The commission is composed of:

- The Presidents or their representatives of the commissions on energy or finances of the National Assembly and the Senate;
- Four qualified personalities designated by the National Assembly and the Senate;
- Four qualified personalities designated by the Government.

Qualified personalities are nominated for a period of six years. Members have to be independent and are not allowed to receive any kind of income from operators and other companies with in the energy sector.

The commission has far reaching authority and can request transmission of any document that it judges necessary to fulfil its mission. It can also request evidence from the administrative authorities. It has to transmit the first report within two years of the promulgation of the Nuclear Waste Law.

A decree might specify application conditions and modalities of the work of the commission and in particular the cost assessment modalities and the type of information to be published by the operators.

The article does not apply to Basic Nuclear Installation directly operated by the state.<sup>73</sup>

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<sup>71</sup> Art. 20

<sup>72</sup> created by the Law of 1 June 2006

<sup>73</sup> It is difficult to judge at this point what this would mean for waste management and disposal facilities.

Table 11 Basis for decommissioning funds required – Provisions of the three main French operators (as of 31 Dec 2004)

Operator/Facility/ Type of backend activity	Kind of facility: NPP = nuclear power plant	Provisions based on overnight / undiscounted costs (in M€)	Provisions based on net present value / discounted costs (in M€)	Discount rate used for discounting	Reference date used for discounting	Remarks
<b>AREVA</b>	<b>Fuel cycle facilities</b>		<b>3,705</b>	<b>3% (5% discount, 2% inflation)</b>		Overnight facility specific figures are not available. The total undiscounted figure does not match the total figure indicated in table 5. The reason is unclear.
<i>La Hague</i>	<i>Reprocessing</i>		2,252			
<i>Marcoule</i>	<i>Reprocessing</i>		158			Waste shipment and storage only
<i>Pierrelatte</i>	<i>Enrichment</i>		47			
<i>Melox</i>	<i>MOX Fab</i>		423			
<i>Cadarache</i>	<i>MOX Fab</i>		220			
<i>Eurodif</i>	<i>Enrichment</i>		492			
<i>Others</i>	<i>various</i>		113			
<b>CEA (civil only)</b>	<b>Research and fuel cycle facilities</b>	<b>6,435</b>	<b>4,267</b>	<b>3% (5% discount, 2% inflation)</b>		
<i>Decommissioning</i>		3,826	2,747			
<i>Clean-up</i>		1,897	1,002			
<i>Facilities and processes</i>		159	143			
<i>Environment</i>		61	52			
<i>VAT</i>		389	323			

Source: CDC 2006

Table 11 follow-up

Operator/Facility/ Type of backend activity	Kind of facility: NPP = nuclear power plant	Provisions based on overnight / undiscounted costs (in M€)	Provisions based on net present value / discounted costs (in M€)	Discount rate used for discounting	Reference date used for discounting	Remarks
<b>EDF</b>	<b>NPPs</b>	<b>48,187</b>	<b>24,705</b>	<b>3% (5% discount, 2% inflation)</b>		
<b>Decommissioning</b>		<b>24,093</b>	<b>13,458</b>			
<i>1<sup>st</sup> Generation NPPs</i>	<i>NPPs</i>	<i>1,916</i>	<i>1,449</i>			
<i>Superphénix</i>	<i>NPP</i>	<i>748</i>	<i>612</i>			
<i>Operating 58 PWRs</i>	<i>NPPs</i>	<i>17,558</i>	<i>7,371</i>			
<i>Last cores* 58 PWRs</i>		<i>3,509</i>	<i>1,617</i>			
<i>Phénix (and div.)</i>	<i>NPPs</i>	<i>362</i>	<i>198</i>			
<b>Waste Management</b>		<b>24,094</b>	<b>13,458</b>			
<i>Reprocessing (incl. La Hague decommissioning)</i>		<i>16,311** (4,189)</i>	<i>9,593 (1,646)</i>			
<i>Waste storage</i>		<i>7,783</i>	<i>3,865</i>			



**Notes pertaining to table on EDF on previous page:**

\*«For EDF SA, this provision covers expenses related to the future loss on unused fuel following the final reactor shutdown. It comprises two types of expenses: write-down of the inventory of fuel in the reactor that will not be totally burnt up when the reactor is shut down, valued at the average price of components in inventories at November 30, 2005; – the cost of fuel reprocessing and the corresponding waste disposal and storage costs for fuel not covered by a provision at the time the plant shuts down. These costs are measured under the same principles as the provisions relating to reprocessing and the removal and storage of the relevant waste at December 31, 2005. Since this provision relates to an obligation that existed at the commissioning date of the nuclear unit containing the core, all costs are fully covered by provision and an asset associated with the provision is recognized as described in note 4.19. Estimates based on the economic conditions of December 2005, these costs amount to €3,419 million (€3,509 million at December 31, 2004). Spread over the forecast disbursement schedule and assuming 2% inflation and a 5% discount rate, an amount of €1,597 million is included in provisions at December 31, 2005 (compared to €1,617 million at December 31, 2004), corresponding to the present value at that date.” [EDF 2006]

\*\*« For EDF SA, the main costs covered by this provision are:

- transportation from the production center to the COGEMA plant at La Hague, reception, storage and reprocessing of burnt fuel from the various types of reactors (including conditioning and storage of waste);
- oxidation and storage of unrecycled uranium obtained from reprocessed fuel;
- recovery and conditioning of old waste from the La Hague site;
- contribution towards final shutdown and dismantling costs for the La Hague reprocessing plant.

Estimated based on the economic conditions of December 2005, these costs amount to €17,198 million (€16,311 million at December 31, 2004). Spread over the forecast disbursement schedule and assuming 2% inflation and a 5% discount rate, an amount of €9,993 million is included in provisions at December 31, 2005 (compared to €9,593 million at December 31, 2004), corresponding to the present value at that date.” [EDF 2006]

Table 12 Decommissioning funds accumulated in relation to expected total costs of future decommissioning of nuclear installations in France (€2004 million)

Operator/ Facilities	Kind of facility: NPP = nuclear power plant	Total decommission ing costs estimated [Mio. Euro]	Provisions accumulated by 31-12-2004 [Mio. Euro]	Provisions accumulated in relation to expected costs [%]	Years of operation until 31-12-2004 in relation to total expected lifetime [%]	Remarks
EDF	NPPs and waste	48,187	24,705	51%	Various	3% (5% discount, 2% inflation)
CEA	Research, fuel cycle and waste	13,211	8,602	65%	Various	3% (5% discount, 2% inflation)
AREVA	Fuel cycle and waste	8,258	4,332	52%	Various	3% (5% discount, 2% inflation)
SOMANU Maubeuge	Nuclear Maintenance	10	6	66%	33%	3% (5% discount, 2% inflation)

Sources: CDC 2006, SOMANU 2006

Table 13 Management of decommissioning funds in France

Operator	Kind of facility: NPP = nuclear power plant	Provisions accumulated by 31-12-2004 [Mio. Euro]	... of which has been accumulated within the own assets of the operator of the facility or its mother company [Mio. Euro]	... of which has been accumulated by the operator of the facility or its mother company within a separated account [Mio. Euro]	... of which has been accumulated in an external fund under public control [Mio. Euro]	... of which has been accumulated in an external fund under mixed private-public control [Mio. Euro]	Share of funds the operator of the facility can access for other activities until the funds are needed for their original decommissioning purpose [%]	Remarks
EDF	NPPs and waste	24,705		24,705	/	/	/	
CEA	Research, fuel cycle and waste	8,602		8,602	/	/	/	
AREVA	Fuel cycle and waste	4,332		4,332	/	/	/	
SOMANU Maubeuge	Nuclear Maintenance	6	6		/	/	?	

Source: CDC 2006, AREVA 2006

Table 14 Investment of AREVA decommissioning funds until they are used for their original purpose

Short name of nuclear facility	Kind of facility	Provisions accumulated by 31-12-2005 [Mio. Euro]	... of which have been invested in bonds* [Mio. Euro]	... of which have been invested in other assets with fixed interest rates** [Mio. Euro]	... of which have been lent to associated or joined companies or to third parties*** [Mio. Euro]	... of which have been invested in other means (shares, mergers & acquisitions, etc.) **** [Mio. Euro]	Interest on invested financial means from decommissioning funds in 2004 [%]	Interest on invested financial means from decommissioning funds in period 2000-2004 [%]	Remarks
AREVA's facilities	Fuel cycle facilities	2,798	1,126	973	129	570			

Source: AREVA 2006

Notes (for further detail refer to Annex 2):

\* Bond and money market mutual funds

\*\* Equity mutual funds

\*\*\* Receivables from CEA for La Hague and Cadarache decommissioning

\*\*\*\* Publicly traded shares

## 4 Transparency of the funding schemes to the public

Traditionally the access to information in the nuclear sector in France is very limited. There are numerous cases of restrictions that are often linked to a simple lack of willingness on behalf of the operators or governmental authorities and sometimes to an extremely restrictive classification practice. In a recent case the spokesperson of the national anti-nuclear organisation was arrested on the grounds that he would have distributed restricted nuclear information.<sup>74</sup> In an unprecedented move, and as a reaction to the arrest, 13 personalities that had participated in the official Public Debates on Radioactive Waste Management and the EPR Project<sup>75</sup>, have signed an Open Letter to the French authorities attracting attention to the report of a working group of the National Commission on Public Debate (CNDP) on "Access to Information"<sup>76</sup>. The Open Letter states that the working group report has demonstrated the "need to be able to access expertise documents in order to allow for a real participative democracy in agreement with the Aarhus Convention signed by France". The letter finishes by stating that "it is not sufficient to ratify conventions or to vote legislation in order for transparency to be implemented".

Decommissioning strategies are outlined in the annual reports of the main operators and of the safety authorities. Partial privatisation and the switching to IFRS standards have forced operators to release at least some information on the financial issues involved. As an illustration: AREVA's Annual Report 2002 had a total of 84 pages, the Annual Report 2005 has increased its volume five times to 449 pages. However, detailed cost figures and site or facility specific information is practically not publicly available. The National Court of Accounts has published a number of reports that have served to release some of the information not otherwise available.

New legislation might lay the grounds to open the books at least to some extent. According to the New Waste Law the operators have to transmit a report to the administrative authority on the status and methodology to calculate backend provisions and composition and management of the earmarked assets. The operator is legally obliged to transmit any requested documentation to the administrative authority.

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<sup>74</sup> On 16 May 06 the spokesperson of the national anti-nuclear network *Sortir du Nucléaire* was arrested and held for 14 hours and his home searched under the pretext that he would be holding a classified document. The 8-page EDF document (that had been leaked months before and widely distributed since) briefly describes the design basis for an airplane crash on an EPR.

<sup>75</sup> Including the president of the EPR Public Debate Commission (CPDP) and the President of the National Federation of the Local Information Committees (ANCLI), see Annex 6

<sup>76</sup> CNDP, *Rapport de restitution du groupe de travail dit « Accès à l'information » - Groupe de travail mis en place dans le cadre du débat public EPR « tête de série » à Flamanville*, October 2005–February 2006 <http://www.debatpublic-epr.org/docs/pdf/bilan-du-debat/rapportgtaccesinfovf.pdf>

The New Waste Law also stipulates the creation of a National Commission for the Evaluation of Decommissioning Costs of Basic Nuclear Installations and the Management of Spent Fuel and Radioactive Wastes<sup>77</sup>. The commission analyses the coherence of the decommissioning strategies and their financial conditions and can publish opinions at any point in time. It produces a triennial report that is public.

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<sup>77</sup> For details see chapter on **Audit, review and control systems**

## 5 Stakeholder analysis

The stakeholders that are involved in the debate, decision-making process and management of nuclear decommissioning and radioactive waste management include operators, public authorities (safety, security, environment, strategy), technical backup, independent scientists and experts, the parliament, trade unions as well as expert and lobby NGOs. The operators' and public authorities' views and positions have been presented throughout other parts of the report. This section therefore will concentrate essentially on other stakeholders' views in the public debate on costs and financing issues and provide a short overview of statements on issues that have or might have an impact on nuclear backend costs and financing. The "Cahier d'acteur" of the Public Debate on Radioactive Waste Management in 2005 constitutes a particularly valuable resource for a collection of statements and opinions.<sup>78</sup>

### 5.1 The Public Authorities

The DIREM (Directorate for Energy and Mineral Resources) within the Subdirectorate for Nuclear Industry of the DGEMP (General Directorate for Energy and Raw Materials) within the Ministry of Economy, Finances and Industry (MINEFI) is responsible for oversight of nuclear backend issues. The human resources within the directorate are limited to three or four equivalent full time staff<sup>79</sup>, roughly one person per main nuclear operator. According to DIREM representatives there are another four to five people within DIDEME (Directorate of Energy Demand and Markets) that are specifically working on EDF oversight issues.<sup>80</sup>

DIREM considers that the passage on IFRS rules has been the occasion to "get concrete" on the operators' side for the cost assessments on decommissioning and waste management.<sup>81</sup> The DIREM representatives consider that the long-term industrial all-reprocessing strategy seems "credible" today and has therefore been selected. It is also the least costly range as calculated by the working group under Ministry auspices in 2005 (see [DGEMP 2005]). The Environment Ministry, officially co-responsible for nuclear safety, does not have any dedicated administrative staff for nuclear oversight and has played virtually no role in the decision making process.

Considering the lack of expert staff within the strategic oversight in the Industry Ministry it is obvious that the authorities are highly dependent on input from the operators. However, the French system guarantees that many of the executives in industry and administration belong to the same small group of elite engineers, which helps to shorten the decision making process and maintain long term targets independent of

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<sup>78</sup> see [http://www.debatpublic-dechets-radioactifs.org/documents/cahiers\\_acteurs.html](http://www.debatpublic-dechets-radioactifs.org/documents/cahiers_acteurs.html)

<sup>79</sup> According to its representatives, the Subdirectorate for Nuclear Industry has only recently been established as a full scale subdirectorate within DGEMP, which still counts only 15 executives (cadres).

<sup>80</sup> Personal communication, interview with Jean Javanni, Head of Mission EC & Multilateral Affairs of DIREM and Cyrille Vincent, Head of Public Policy and Supervision Bureau of DIREM, Paris, 8 June 2006

<sup>81</sup> It is remarkable that the corporate development and accounting standards have had more impact on availability of data – public or not – than decades of public oversight.

electoral timeframes. In the case of the nuclear sector a large share of senior executives belong to the “Corps des Mines”<sup>82</sup>. Their role in the design, implementation and control of the nuclear decommissioning and waste management scheme in France is predominant.<sup>83</sup>

The Nuclear Safety Authorities (ASN), for the first time in their Annual Report 2005 have expressed a strong interest in the financing aspect of nuclear backend issues (see previous chapters). There is also a clear wish to get closer involved in the analysis and decision making process. For example, it was not appreciated that ASN was not invited to join the DGEMP led working group on final storage costs. The issue for ASN is not to control the finances but the safety of decommissioning and finances can have an obvious impact on safety. ASN demands a “regulatory control mechanism”.<sup>84</sup> ASN’s role is however rather consultative than of executive control when it comes to the financial aspects. ASN had strong influence on the general move towards immediate decommissioning. The key factor being the estimated negative effect of the loss of memory.

## 5.2 The Parliament

*The National Evaluation Commission is a panel of expertise, and not of debate The representatives of NGOs therefore are not apte to be represented there.*<sup>85</sup>

MP Claude Birraux, Rapporteur for the New Waste Law

The National Assembly’s activities on nuclear issues have been dominated for the last 15 years by an unusual coalition of two members of opposite parliamentary groups, Christian Bataille, from the Socialist Party, and Claude Birraux of the majority group UMP. Bataille gave his name to the first law on nuclear waste research from 1991, and 15 years later Birraux was rapporteur of the Committee of Economic Affairs for the New Waste Law. The unusual cooperation between the two very pro-nuclear members

<sup>82</sup> The Corps des Mines is the most prestigious of the technical state engineering corps. More than two thirds are top graduates from the military Ecole Polytechnique. There are about 560 active members. Most of the key nuclear positions are occupied by Corps des Mines engineers including the CEO of AREVA, the nuclear advisors to the Ministers for Industry and Environment, the head of the nuclear safety authorities, the DG of ANDRA, the DIDEME (he is the former DG of ANDRA), the DGEMP, the Head of the DIREM Nuclear Industry Subdirectorate, the Head of Public Policy and Supervision Bureau in the Nuclear Industry Subdirectorate, etc.

<sup>83</sup> Many NGOs, independent experts and prominent representatives of the civil society, including former environment ministers Corinne Lepage and Dominique Voynet have criticised the monopoly of the Corps des Mines over nuclear policy in particular and its lack of accountability. In 1997 the Vice-President of the Conseil Général des Mines (the Industry Minister is the President in office) that orients the career of the Corps des Mines engineers had to step back after an NGO had filed a complaint. He was accumulating his Corps des Mines position with the position of the head of COGEMA. In other words, he was nuclear operator and at the same time had strong influence on the nomination of the head of the safety authorities and its regional representatives, also Corps des Mines positions.

<sup>84</sup> Personal communication, Jean-Luc Lachaume, Deputy DG, Philippe Bodénez, Deputy head of sub-directorate for research facilities, dismantling polluted sites and radioactive waste, interview, Paris, 9 June 2006

<sup>85</sup> Original French quote : “La commission nationale d’évaluation est une instance d’expertise, et non de débat. Les représentants des associations n’ont donc pas vocation à y être représentés”.



had also significant effect on the substantial work of the Assembly and Senate's joint Scientific and Technological Option Assessment Office (OPECST). Public hearings were largely dominated by evidence from establishment and nuclear lobby representatives from inside and outside the country.

It is all the more surprising that the Socialist Group decided not to vote the New Waste Law but to abstain. And it was Christian Bataille who explained the group's vote in the National Assembly<sup>86</sup>: "The Senate has brought some improvements but the funding management problem persists. We remain partisans of an external dedicated fund, controlled by public authorities." The earmarked funds should be administered by a public financial institution like the *Caisse des Dépôts*. Bataille points to similar examples in the US, Japan, Finland and Sweden.

In addition, the Socialist group considers that the waste property should be transferred to ANDRA in return for a fee that would go to the financing of interim or final storage sites. The multiplication of waste producers, Bataille argues, could eventually lead to waste ending up with ANDRA that does not have an identifiable owner anymore. And "one could imagine that France would have to put pressure on foreign companies – like American pension funds – which is not unlikely". Finally reversibility should represent an "intangible principle" in order to reassure the citizens.

In the rapporteur's reaction Claude Birraux considers that new legislation scheduled for 2015 should take care of the reversibility, storage methodology definition and eventual property transfer. Until then the responsibility of the waste should remain with the producers and the funds are considered secured by the government.

### 5.3 National Commission on Public Debate

In its conclusions of the Public Debate on Radioactive Waste Management in 2005, the National Commission on Public Debate notes that "the ethical considerations that have often been present in the debates and that have strongly inspired positions taken, have taken the form of the demande for justice, equity, balance (all these terms have been used) between generations: it is now that one must foresee and guarantee the financing of future expenses – and not delay it to future generations (...)"<sup>87</sup>.

### 5.4 Trade Unions

The left-liberal trade union CFDT considers that research on geological disposal should continue and that a second laboratory in a different geological formation should be built. The implementation would have obvious cost implications. The CFDT states that "besides the fact that this is a necessary condition for a real choice on storage to come into existence, it will allow to rupture the link between laboratory and storage site, and will

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<sup>86</sup> Christian Bataille, Assemblée Nationale, 15 June 2006

<sup>87</sup> Commission nationale du débat public, *Bilan du débat public sur les options générales en matière de gestion des déchets radioactifs de haute activité et de moyenne activité à vie longue. septembre 2005 - janvier 2006*, established by the president of the CNDP, 27 January 2006

contribute this way to the acceptability of the geological storage to the citizens". The trade union also wishes "the establishment of a manager of decommissioning and waste management funds with a legal entity that is separate from those of the operators".

## 5.5 Independent Experts

The independent laboratory CRIIRAD has opposed the New Waste Law in particular because it would "give wrong guarantees (in particular concerning reversibility and the return of foreign radioactive materials) and constitutes a real denial of democracy". CRIIRAD also considers the final geological storage project at Bure illegal because the 1991 waste law required the construction and exploration of two laboratories prior to selection of a storage site. CRIIRAD calls for the abrogation of the New Waste Law and has announced that it might file a complaint with the Constitutional Court.<sup>88</sup>

The other independent laboratory ACRO has severely criticised the reprocessing option, which it considers "a highly polluting and expensive operation" and called in particular for the return of all foreign reprocessing wastes, including the relative share of wastes stemming from the decommissioning of the reprocessing facilities.<sup>89</sup>

## 5.6 Environmental NGOs

According to the official estimates, the choice of the spent fuel management option is the largest single cost uncertainty factor. Operators and government do not currently envisage any alternative to the all-reprocessing option. However, this option is highly controversial and it seems difficult to exclude any policy change at any point in time. The effect on decommissioning and waste management costs could be in the range of several tens of billions of euros.

In a joint statement five large French environmental organisations and federations (France Nature Environnement, WWF, Friends of the Earth, Greenpeace and Agir pour l'Environnement) have condemned the current French reference reprocessing scenario: "The abandoning of reprocessing is one of the first measures to take from the point of view of a responsible nuclear waste management".<sup>90</sup>

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<sup>88</sup> CRIIRAD (Commission de recherche et d'information indépendantes sur la radioactivité), Press releases, 15 and 16 June 2006

<sup>89</sup> ACRO (Association pour le contrôle de la radioactivité dans l'ouest), *Ces déchets nucléaires dont on ne sait que faire*, Cahier d'acteur sur le Débat Gestion des déchets nucléaires, 2005

<sup>90</sup> Agir pour l'Environnement, Amis de la Terre, France Nature Environnement, Greenpeace, WWF, "Les déchets nucléaires – un casse-tête insoluble, Cahier d'acteur sur le Débat Gestion des déchets nucléaires, 2005

The *Nuclear Phase-out Network (Réseau Sortir du Nucléaire)*, a national federation of NGOs that claims 720 member organisations, opposes the New Waste Law. The network criticises that only 12 of 577 MPs have voted the first draft of the bill<sup>91</sup>, the “pseudo reversibility” that would only hide the final nature of the geological storage and the financial payments to municipalities in the vicinity of the potential storage site. The network calls for the abrogation of the New Waste Law.<sup>92</sup>

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<sup>91</sup> The final vote on 15 June 2006 has been carried out by hand sign. There has been neither count nor nominal vote.

<sup>92</sup> Réseau Sortir du Nucléaire, Press release, 15 June 2006

## 6 Conclusions and recommendations

### 6.1 Conclusions

The regulatory situation and organisation of nuclear decommissioning and waste management in France is in the middle of profound changes. New legislation has just been voted but implementation practice needs yet to be developed. Operators have radically modified their financing and organisational approach to backend activities but cannot yet provide practical experience under the new circumstances.

After national public and parliamentary debates new legislation on nuclear waste research and management has been adopted on 15 June 06 that includes specific wording on the financing of decommissioning and waste management operations. Key articles of the new *Law on the Programme Relative to the Sustainable Management of Radioactive Materials and Wastes (hereafter New Waste Law)*<sup>93</sup> includes the legal requirement to elaborate a National Plan for the Management of Radioactive Materials and Wastes and a National Inventory of Radioactive Materials and Wastes. Both have to be updated every three years. The National Radioactive Waste Management Agency ANDRA has to set up an internal restricted fund in order to finance the storage of long lived high and medium level wastes. The fund will be fed by contributions from the nuclear operators under bilateral conventions. The nuclear operators have to set up internal restricted funds covered by dedicated assets managed under separate accountability. A National Financing Evaluation Commission of the Costs of Basic Nuclear Installations Dismantling and Spent Fuel and Radioactive Waste Management will be established that comprises representatives of the National Assembly and the Senate as well as the Government and a number of experts that have to be independent of the nuclear operators and the energy industry.

Partial privatisation led key nuclear players AREVA and EDF to advance the reorganisation of their backend provisions and accountancy practice. The CEA is following suite. The three companies have set up restricted internal funds for the financing of future backend charges. The CEA was the first to set up a specific fund for its civil activities in 2001, while AREVA was the first to cover provisions by dedicated assets. EDF is expected to have built up earmarked assets by 2010. However, there is also considerable political pressure to set up separate funds (see hereunder).

The sums involved are very significant. The French Court of Accounts has calculated provisions totalling € 65 billion (undiscounted) for the three main operators as of the end of 2004<sup>94</sup>.

<sup>93</sup> *Loi de programme relatif à la gestion durable des matières et des déchets radioactifs*, 15 June 06, see Annex 7

<sup>94</sup> The figure is even higher, almost € 70 billion, if one does not take into account some overlap stemming from doubling provisions due to joint operation by several operators of some facilities.

As a so far unique and highly recommendable feature, France has set up specific category of “very low level waste”<sup>95</sup> and has created a specific dedicated waste management scheme including a dedicated final disposal site that has been put into operation in 2003 in Morvilliers in the Aube Department.

## 6.2 Uncertainties

While the new legal framework considerably changes the basis for the future availability of sufficient funding for nuclear decommissioning and waste management activities in France, a large number of uncertainties remain. These include the following uncertainties, some of which could have multi-billion euro effects on nuclear backend cost calculations:

- The cost calculations underlying the provisions are non-transparent and there is no public access to detailed data<sup>96</sup>; the administrative authorities do either have limited manpower<sup>97</sup> or are not consulted.<sup>98</sup> In the past, some cost calculations have proven wrong by an order of magnitude or more.
- The spent fuel management policy choice has extreme impact on future costs. The final disposal cost estimates for long lived high and intermediate level wastes vary by a factor of four or almost € 45 billion between € 13.5 and € 58 billion. The current limitation of the reference scenario to the all-reprocessing option – presented as the cheapest geological disposal option<sup>99</sup> – has not been justified. In fact, a number of national and international systemic studies have illustrated the global cost advantage of the direct disposal option over the reprocessing option. In addition, the French government and operator reference scenario foresees the reprocessing of spent MOX fuel after 2025. Curiously 2025 is the planned closure date for the current La Hague reprocessing plants. Therefore MOX reprocessing would pre-suppose the construction of new reprocessing plants. No specific cost item relating to such an investment can be identified in the available costing figures from operators, waste management agency or government.
- There is considerable opposition against the funding scheme adopted (internal restricted), which has led the largest opposition group (Socialist Party) in the

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<sup>95</sup> The influence of the French civil society on nuclear decision-making might be higher than generally admitted. The former CEA director for waste management and clean-up, Robert Lallement, declared that “in France, following various events including Chernobyl, following obstinate action by anti-nuclear organisations, following complacency by the media and the weakness of the health authorities, following also the difficulty to present a demonstration generally admitted on the effect of low doses of radiation, the safety authorities and the operators have decided that anything in a nuclear installation that could have added radioactivity would never be sent to an ordinary waste dump. There is therefore no threshold anymore.” *Revue Générale Nucléaire*, October-November 2004

<sup>96</sup> The main operators have refused to transmit *any* cost data to the author.

<sup>97</sup> Approximately one dedicated full time staff person per key operator in the Industry Ministry.

<sup>98</sup> The Nuclear Safety Authorities were not invited to join the Industry Ministry led Working Group that elaborated the reference cost scenario for geological disposal in 2005 (see [DGEMP 2005])

<sup>99</sup> according to [DGEMP 2005] ; this is highly contradictory to a number of other national and international studies, for example [CDP 2000] and [Girard 2000]

French National Assembly in a surprise move to abstain from voting the New Waste Law and to demand external funds instead of internal restricted ones. Two other parliamentary representations (Communist Party<sup>100</sup>, Green Party) have voted against the law.

- There is considerable opposition against the current backend strategy (reprocessing plus geological storage) from the civil society (NGOs, independent scientists, consumer groups). The implementation of a second laboratory, legally required according to the 1991 waste law and firmly requested by trade unions and independent experts, has not been possible in the past due to fierce local opposition<sup>101</sup>. Policy changes in the future due to public pressure or legal claims are difficult to exclude.<sup>102</sup>
- The current cost estimates are based on the opening of a final geological disposal site for long lived intermediate and high level wastes in 2020. After six years the laboratory project at Bure is already more than two years behind schedule.
- Safety analysis based modifications of the technical specifications in waste conditioning, packaging and storage can have significant impact on costs.<sup>103</sup>
- The conditioning, sometimes reconditioning, and packaging of some waste categories (including over 60,000 bitumen intermediate level waste packages for which reconditioning technologies are under development but still not in operation, several thousand tons of contaminated graphite, several hundred tons of spent MOX fuel) is still only in its development phase. Cost calculations necessarily have large uncertainties associated.
- Following the shut-down over a two year period of a nuclear facility (for example after an incident or an accident), the safety authorities can order the final closure and decommissioning of the facility. This could have severe impact on cost calculations and availability of backend funding. There are no rules how to deal with decommissioning costs not covered by provisions in such a case.

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<sup>100</sup> Traditionally very pro-nuclear, the Communist Party spokesperson in her vote explanation has called the text « insuffisant in research and financing ».

<sup>101</sup> A mediation mission attempt by MP Christian Bataille failed due to firm and sometimes radical opposition in 25 departments.

<sup>102</sup> The influence of the French civil society on nuclear decision-making might be higher than generally admitted. The former CEA director for waste management and clean-up, Robert Lallement, declared that “in France, following various events including Chernobyl, following obstinate action by anti-nuclear organisations, following complacency by the media and the weakness of the health authorities, following also the difficulty to present a demonstration generally admitted on the effect of low doses of radiation, the safety authorities and the operators have decided that anything in a nuclear installation that could have added radioactivity would never be sent to an ordinary waste dump. There is therefore no threshold anymore.” *Revue Générale Nucléaire*, October-November 2004

<sup>103</sup> The decrease of the admitted surface temperature of high-level waste from 150°C to 90°C multiplied the storage cost for this waste category by a factor of four.

- Some materials currently not classified as waste might have to be managed as waste in the future (for example reprocessed and depleted uranium, a portion of separated plutonium, spent plutonium fuels and plutonium waste).

### 6.3 Preliminary Recommendations

There are three key issues involved with the financing of nuclear decommissioning and waste management:

1. The reliable evaluation of costs that have to be covered far in the future;
2. The respect of the polluter-pays principle and thus the avoidance of *privatisation of benefits – mutualisation of costs* effects;
3. The availability of funds at the very moment when disbursements are necessary.

Preliminary recommendations on 1.:

- An independent status report (commissioned by the European Commission?) should be established on the most cost sensitive issues and in particular on the large plutonium facilities at Marcoule, La Hague and Cadarache, the former uranium mining sites and the waste storage facility CSM at La Hague.
- Full public access to all underlying data that is relevant for the calculation of costs has to be guaranteed.
- The cost calculations shall include a representative variety of spent fuel management, decommissioning and waste storage scenarios.
- A fixed percentage of the annual provisions (for example 1%) shall be made available for the independent auditing of the cost evaluations and fund management.

Preliminary recommendations on 2.:

- Provisions should be guaranteed in a way as to leave future spent fuel management and waste storage policy options open. It is not acceptable that operators could potentially argue in the future that, for example, due to past provision and fund management policy they don't have any financial option but to continue plutonium separation and use.
- The decision making process on spent fuel management and waste storage policy should guarantee not only the full scale implementation of access to information (according to the Aarhus Convention, and the respective EU Directives<sup>104</sup>) but the compulsory integration of independent expertise and other

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<sup>104</sup> The CNDP Working Group on Access-to-Information has developed a number of worthwhile ideas, see [CNDP 2006]

non-technical expression by the civil society into the decision making process. The current scheme of hearings and Public Debates does have little practical and no formal influence of the decision-making.

Preliminary recommendations on 3.:

- The availability of funding should be assessed including under scenarios like the premature shut-down of a specific facility (for technical, industrial, economic, strategic or political reasons) or the non-replacement of plants or the phase-out of nuclear power. The limited availability of backend funding shall not close any future backend management options.
- The externalisation of funds should be carefully reassessed.



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**SOMANU 2006:** Replies to questionnaire, transmitted by Claude Moreau, Director General of SOMANU, by e-mail dated 1 June 2006

## 8 List of Annexes

Annex 1 : *Case Study : Nuclear facilities operated by SOMANU*, May 2006

Annex 2 : *AREVA assets earmarked for end-of-life-cycle operations*, Excerpt from Annual Report 2005

Annex 3 : *AREVA provisions for end-of-life-cycle operations*, Excerpt from Annual Report 2005

Annex 4 : *CEA List of facilities already decommissioned or in the course of decommissioning*

Annex 5 : *CEA Provisions for liabilities and charges ; Dismantling assets*, Excerpt from CEA Annual Report 2004

Annex 6 : *Secret défense : Lettre ouverte à l'attention des pouvoirs publics*, 19 mai 2006

Annex 7 : *The New Waste Law - Loi n° 2006-739 du 28 juin 2006 de programme relative à la gestion durable des matières et déchets radioactifs*, Journal Officiel de la République Française, 29 Juin 2006

**Annex 1**

# **MYCLE SCHNEIDER CONSULTING**

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## **Comparison among different decommissioning funds methodologies for nuclear installations**

**Commissioned by the European Commission  
Project n°TREN/05/NUCL/S07.55436**

## **Case Study : Nuclear facilities operated by SOMANU**

**Paris, May 2006**

**Future decommissioning strategies**

**What are the principal strategies chosen?**

Immediate dismantling at the closing of the site, removing of the contaminated materials and waste management by ANDRA (entombment).

**What are the waste management and disposal options chosen?**

Entombment by ANDRA.

**Start and expected end of decomm****issioning activities? Expected duration of the different decommissioning stages?**

Expected start : about 2040; Expected end: about 2042

**Who is responsible for decommissioning costs / managing of decommissioning activities?**

SOMANU

**What are the estimated costs (absolute values)? What is/was the price basis for these cost estimates?**

“Study on the development of methodology for cost calculation and financial planning of decommissioning operations” established for European commission by EDF and Framatome NP.

**What are the main cost drivers for the different types of nuclear installations and types of decommissioning activities?**

Dismantling labour for facilities

**How are the costs for the different decommissioning stages and types of decommissioning activities estimated?**

Expert opinion technique

**Who estimates the costs?**

Expert Technique

**Who supervises the estimate of costs? Is there any public or independent control of cost estimates?**

Supervised by SOMANU, validated by EDF

**Are there any defined algorithms or generally accepted software to estimate the decommissioning costs?**

Expert technique methodologies

**Are there any reference cases used/calculated on which the cost estimates are based?**

Yes

Funds and fund management

**Who is responsible for setting up the provisions/accruals?**

SOMANU

**How are the accruals set up? Is collection of all financial means for decommissioning defined at start-up of facility operation and ended before shut down?**

Yes

**When should the total funds be available?**

At the closest foreseen date of shut down

**Do the provisions cover all the cost items mentioned in Table 2?**

Yes

**How are the financial provisions transferred to the fund?**

Included in selling prices

**Legal requirement or (international) standards applied to (accounting) methodology of setting aside funds?**

IFRS rules

**What is the base for setting up the accruals?**

Discount rates fixed by AREVA group

**In how far is it secured that contributions will change in case of change of cost estimates or other important changes?**

Regular new evaluations and validation by "Commissaires aux comptes"

**Who manages the funds?**

SOMANU

**Is the fund internally/externally, segregated/non-segregated, public/private managed?**

Internally

**Who has access to the funds to what extent and according to which regulations?**

SOMANU

**Who decides about the investment of the financial means /investment strategy of the funds?**

SOMANU

**Are there any liquidity requirements?**

No

**What are the internal control systems, audits, boards?**

AREVA audit

**Are there external control systems, systematic audits, reviews?**

"Commissaires aux comptes"

**How are the financial means used until they are needed for their original decommissioning purposes?**

Not used (only provisions)

**Is insurance available and used to cover financial risks?**

No

**What happens in case of early shut down of the nuclear facility?**

Only SOMANU

**What happens to liabilities, responsibilities and funds in case of transfer of ownership?**

New owner of the nuclear facility is responsible for

**Is there any protection of funds in case of insolvency of funds manager or operator of the facility?**

NA

Table 15 Selection of nuclear installations operated by SOMANU in France

<b>Nuclear facility</b>	<b>Short name</b>	<b>Country</b>	<b>Kind of facility</b>	<b>Output /Nominal capacity</b>	<b>Operational period</b>	<b>Operating company</b>	<b>Name of quoted companies holding shares in the nuclear facility, if any</b>	<b>Percentage of shares held [%]</b>	<b>Decom started/will start in year</b>	<b>Decom stage</b>	<b>Analysed in this report</b>
Nuclear maintenance facility (SOMANU) Maubeuge	BNI-143	F	Nuclear maintenance facility	/	1986-	SOMANU	Jeumont SA Intercontrôle STMI	51% 34% 15%	2040	/	x



Table 16 Overview on decommissioning costs for SOMANU nuclear maintenance facility (in prices of 2004)

Decommissioning activity	Years the activity took place / is expected to take place	Total decommissioning costs [Mio. Euro]	Annuity of decommissioning costs in relation to output over lifetime	Remarks e.g. with regard to time horizons and interest rates used for calculation, or with regard to the question in how far any transport between processing facilities is taken into account
Facility shutdown and pre-decommissioning activities	2040 (2 years)		350k€ til 2006 100k€ til 2040	
Management of (low and intermediate) radioactive wastes and disposal of these wastes covering the whole lifetime of the facility		3,2		
Management of other radioactive waste from operation of the facility (processing, storage and disposal of low and intermediate level waste from operation) covering the whole lifetime of the facility		/		
Safe enclosure		0,3		
Dismantling (nuclear) and decontamination activities		6,4		
Decommissioning waste management (processing, storage and disposal of radioactive waste from decommissioning)				
Decommissioning of non-radioactive parts (conventional dismantling)		Not defined		
Site restoration, cleanup and landscape		Not defined		
Supporting programmes for employees		Not defined		
Supporting programmes for regional development		Not defined		
<b>TOTAL</b>			350k€ til 2006 100k€ til 2040	

Source: SOMANU 2006

Dismantling evaluation for SOMANU (December 2005)

Table 17 Decommissioning funds accumulated in relation to expected total costs of future decommissioning of SOMANU's nuclear installations (in prices of 2004)

Short name of nuclear facility grouping for types of facilities possible	Kind of facility	Total decommissioning costs estimated [Mio. Euro]	Provisions accumulated by 31-12-2004 [Mio. Euro]	Provisions accumulated in relation to expected costs [%]	Years of operation until 31-12-2004 in relation to total expected lifetime [%]	Remarks e.g. with regard to time horizons and interest rates used for calculation
Nuclear maintenance facility (SOMANU) Maubeuge	Nuclear Maintenance facility	9,9	6,3	66%	33%	

Table 18 Investment of decommissioning funds until they are used for their original purpose

Short name of nuclear facility grouping for types of facilities possible	Kind of facility	Provisions accumulated by 31-12-2004 [Mio. Euro]	... of which have been invested in secure state bonds [Mio. Euro]	... of which have been invested in other assets with fixed interest rates [Mio. Euro]	... of which have been lent to associated or joined companies or to third parties [Mio. Euro]	... of which have been invested in other means (shares, mergers & acquisitions, etc.) [Mio. Euro]	Interest on invested financial means from decommissioning funds in 2004 [%]	Interest on invested financial means from decommissioning funds in period 2000-2004 [%]	Remarks
Nuclear maintenance facility (SOMANU) Maubeuge	Nuclear Maintenance facility	6,3	/						

## Annex 2: AREVA's Backend Assets (Excerpt from Annual Report 2005)

### NOTE 14. ASSETS EARMARKED FOR END-OF-LIFE-CYCLE OPERATIONS

This heading is comprised of the following:

<i>(in millions of euros)</i>	December 31, 2005	January 1, 2005*
Receivables related to decommissioning	129	110
<b>Earmarked assets</b>	<b>2,669</b>	<b>2,398</b>
<b>Total</b>	<b>2,798</b>	<b>2,508</b>

\* Including IAS 39.

Receivables related to decommissioning include mostly a receivable resulting from the execution of a contract under which the CEA agreed to fund a share of decommissioning expenses at the La Hague and Cadarache plants. This receivable, which bears interest

at a rate of approximately 5%, represents €123 million as of December 31, 2005 (including Value Added Tax). This receivable has no set due date.

The portfolio of assets earmarked to fund end-of-life-cycle expenses includes the following:

<i>(in millions of euros)</i>	December 31, 2005	January 1, 2005
<b>IN MARKET VALUE</b>		
Publicly traded shares	570	977
Equity mutual funds	973	833
<b>Bond and money market mutual funds</b>	<b>1,126</b>	<b>588</b>
<b>Total</b>	<b>2,669</b>	<b>2,398</b>
<b>BY REGION</b>		
Euro zone	2,164	1,972
Non-euro Europe	502	424
Other	2	1
<b>Total</b>	<b>2,669</b>	<b>2,398</b>

#### Purpose of earmarked portfolio

As a nuclear facility operator, the AREVA group has a legal obligation to secure and decommission its facilities when they are shut down permanently, in whole or in part. AREVA must also sort and package waste and scrap from past operations or from facility decommissioning, based on applicable regulations, for the disposal of final waste (see Note 25).

To meet its share of this obligation, the Group has segregated part of its liquidities to cover future facility decommissioning and waste disposal expenses. A portfolio of assets earmarked to pay for these expenses was thus established.

This portfolio was constructed based on a budget of disbursements. These operations are scheduled to take place, for the most part, during the 2025-2060 timeframe. Accordingly, the portfolio is managed with long-term objectives.

The portfolio is invested in short- and long-term bonds and in European equities, including direct and indirect holdings in publicly traded French companies and in independently managed European equity mutual funds. As of December 31, 2005, the portfolio comprised 58% equities (75% as of January 1, 2005) and 42% bonds (25% as of January 1, 2005).

Allocations by asset class, and changes in allocations over time, are consistent with asset allocation strategies reviewed by AREVA's Cleanup and Decommissioning Fund Monitoring Committee.

AREVA relies on outside advisors to monitor portfolio management with a long-term perspective and to ensure that the overall approach is consistent with the Group's objective. Since January 1, 2005, overall portfolio performance is benchmarked to the MSCI Equity Europe index for its equity component and to the FTSE euro zone Government Bond aggregate index for its interest rate component.

## Publicly traded shares

AREVA's portfolio of publicly traded shares is shown below.

Securities held	Number of shares	Market value as of December 31, 2005	Market value as of January 1, 2005
AGF	-	-	46
Suez	-	-	447
Michelin	1,774,225	84	89
Saint-Gobain	6,328,000	318	280
Schneider	2,220,782	167	114
<b>Total publicly traded shares</b>		<b>570</b>	<b>977</b>

The fund managers must follow strict investment guidelines at all times, listed below.

### Composition of bond mutual funds

Bond mutual funds must invest:

- a minimum of 80% of their assets in euro-denominated bonds;
- no more than 20% of their assets in bonds denominated in US dollars or in non-euro zone European Union currencies, in which case the foreign exchange risk must be hedged.

### Risk assessment

Investment in equities is not allowed. Each fund's sensitivity to interest rate fluctuations must be between a minimum of 0 and a maximum of 5. Average sensitivity as of June 30, 2005, was 2.04. The securities selected must be rated by Moody's and/or Standard & Poor's in accordance with the table below:

	Moody's	S&P
0-1 year	P1	A1
1-4 years	Aa3	AA-
4-7 years	Aa1	AA+
> 7 years	Aaa	AAA

### Derivatives

The sole purpose of derivatives is to hedge existing positions. Total nominal commitments may not exceed the fund's net assets.

### Fund valuation

The bond funds' Net Asset Value is determined by valuing the securities held by each fund at market value on the last day of the period.

## Dedicated equity funds

### Composition of equity funds

Some of the assets earmarked to fund future cleanup and dismantling operations are invested, with a long-term objective, in equity funds dedicated to AREVA. The funds are fully invested in equities. Cash from transactions is held only on a temporary basis. A mutual fund representing 2% of the portfolio's total value is invested in French equities. All other funds invest at least 90% of their assets in equities of E.U. companies. No single security accounts for more than 5% of the total assets of dedicated equity funds.

### Risk assessment

The performance of mutual funds invested in European equities, other than French equities, is benchmarked to the MSCI Europe ex France net dividend reinvested index. The tracking error for mutual funds as a whole is between 2 and 3 over the long-term. Fund trends therefore closely track the index.

### Derivatives

The sole purpose of derivatives is to hedge existing positions. Total nominal commitments may not exceed the fund's net assets.

### Fund valuation

The funds are valued based on their net asset value, corresponding to the market value of the securities held by each fund on the last day of the period.

### Position as of December 31, 2005

The portfolio's market value based on year-end closing prices is €2,669 million, compared with €2,398 million as of January 1, 2005.

The portfolio is designed to cover all end-of-life-cycle obligations expected to be on the balance sheet by the time decommissioning operations are performed.

As of December 31, 2005, the portfolio comprised 58% equities (75% as of December 31, 2004) and 42% bonds (25% as of December 31, 2004). The decrease in equity investments is due to the reclassification of the Suez shares, which are now recognized under "Other non-current financial assets" (see Note 16). These shares were temporarily replaced with money market mutual funds.

The AGF shares were sold to finance end-of-life-cycle obligations disbursements in 2005, in particular the final payment due to the CEA for the decommissioning of the Marcoule plant.

A review of the portfolio's strategic allocation is being carried out.

The table below presents the allocation by sector of all equity mutual funds included in the portfolio.

Sectors in %	All funds
Energy	11
Base products	5
Manufacturing	8
Cyclical consumer goods	8
Non-cyclical consumer goods	11
Health	11
Finance	30
Information technologies	3
Telecom	7
Utilities	5
<b>Total</b>	<b>100</b>

### Annex 3: AREVA's Backend Provisions (Excerpt from Annual Report 2005)

## NOTE 25. PROVISIONS FOR END-OF-LIFE-CYCLE OBLIGATIONS

<i>(in millions of euros)</i>	December 31, 2005	January 1, 2005	<i>(in millions of euros)</i>	December 31, 2004	January 1, 2004
Decommissioning of nuclear facilities	3,262	3,154	Decommissioning of nuclear facilities	3,154	4,752
Waste retrieval and packaging	1,228	1,177	Waste retrieval and packaging	1,177	3,523
<b>Provisions for end-of-life-cycle operations</b>	<b>4,490</b>	<b>4,332</b>	<b>Provisions for end-of-life-cycle operations</b>	<b>4,332</b>	<b>8,275</b>

The table below summarizes the AREVA balance sheet accounts affected by the treatment of end-of-life-cycle operations.

<i>(in millions of euros)</i>	December 31, 2005	January 1, 2005		December 31, 2005	January 1, 2005
<b>ASSETS</b>			<b>LIABILITIES</b>		
End-of-life-cycle asset (Note 12.)	2,208	2,177	Provisions for end-of-life-cycle operations	4,490	4,332
– AREVA share <sup>(1)</sup>	163	162	– funded by AREVA	2,444	2,317
– third party share <sup>(2)</sup>	2,045	2,015	– funded by third parties <sup>(2)</sup>	2,045	2,015
– third party asset (Marcoule)	-	-	– provision (Marcoule)	-	-
Assets earmarked to finance end-of-life-cycle obligations <sup>(3)</sup>	2,675	2,219			

<i>(in millions of euros)</i>	December 31, 2004	January 1, 2004		December 31, 2004	January 1, 2004
<b>ASSETS</b>			<b>LIABILITIES</b>		
End-of-life-cycle asset (Note 12.)	2,177	5,786	Provisions for end-of-life-cycle operations	4,332	8,275
– AREVA share <sup>(1)</sup>	162	171	– funded by AREVA	2,317	2,215
– third party share <sup>(2)</sup>	2,015	2,115	– funded by third parties <sup>(2)</sup>	2,015	2,115
– third party asset (Marcoule)	0	3,500	– provision (Marcoule)	0	3,945
Assets earmarked to finance end-of-life-cycle obligations <sup>(3)</sup>	2,281	2,234			

(1) Amount of total provision to be funded by AREVA still subject to amortization.

(2) Amount of the provision to be funded by third parties.

(3) Portfolio of financial assets earmarked to finance AREVA's share of the total provision (€2,444 million as of December 31, 2005).

<i>(in millions of euros)</i>	NCA as of January 1, 2005	Reversal (when risk has materialized) Expenses for the year	Discounting reversal	Change in assumptions, budgets, etc.	NCA as of December 31, 2005
Decommissioning provision	3,154	(33)	143	(2)	3,262
Provision for waste retrieval and packaging	1,177	(4)	51	4	1,228
<b>Total</b>	<b>4,332</b>	<b>(37)</b>	<b>194</b>	<b>2</b>	<b>4,490</b>

## Nature of the commitments

As a nuclear operator, the AREVA group has a legal obligation to secure and decommission its facilities when they are shut down permanently. The Group must also package, in accordance with prevailing standards, the various waste types generated by operating activities, which could not be processed during treatment. Group facilities subject to these obligations include facilities in the front-end of the fuel cycle, in particular Eurodif's enrichment plant in Pierrelatte, but they are predominantly facilities at the back-end of the fuel cycle, including the treatment plants at La Hague and the MELOX and Cadarache uranium/plutonium (MOX) fuel fabrication plants.

Under certain circumstances, essentially in the case of used fuel treatment services, customers have agreed to fund a portion of the cost related to decommissioning operations and to the disposal of final waste, of which they remain the owners. For AREVA, this has the effect of transferring the financial responsibility for decommissioning, waste retrieval and packaging from the Group to third parties.

In December 2004, the CEA, EDF and COGEMA signed an agreement regarding the Marcoule plant. The CEA will assume the responsibilities of owner-operator of the site and will be responsible for funding the site cleanup effort. This agreement does not cover final waste disposal costs.

It provides for the payment of a final consideration to the CEA decommissioning fund by EDF and AREVA NC, corresponding to their respective financial obligations. AREVA NC's obligation is €427 million (subject to escalation from January 2004). This amount was recognized as a provision in the 2003 financial statements and subsequently paid in full, half at the end of 2004 and half at the beginning of 2005.

Since December, 12 2004, AREVA's only provision concerning the Marcoule site corresponds to the Group's share of obligations for final waste retrieval and disposal.

The expenses relating to these commitments will be incurred between 2006 and 2060, based on forecast facility shut-down and the scheduling of operations. Cash spending for decommissioning of the UP2-800 and UP3 plants in La Hague is expected to occur during the period 2040-2060.

## Determination of decommissioning provisions

### *Dismantling*

Decommissioning obligations are calculated facility by facility as follows:

- The Group's dismantling standards correspond to the following final condition: buildings are decontaminated where they stand and all nuclear waste areas are decommissioned to conventional waste status. This corresponds to a decommissioning level of between levels 2 and 3 of the International Atomic Energy Agency (IAEA) scale, which is currently under review.
- Detailed decommissioning and waste management cost estimates for back-end facilities were prepared by SGN. As prime contractor for the construction of the majority of the Group's treatment and recycling facilities, this engineering firm was judged to be the most qualified to select methods for the decommissioning of these facilities. Eurodif prepared the decommissioning cost estimates for the enrichment business.
- The estimates are revised annually to take inflation into account. These expenses are then allocated by year, adjusted for inflation and discounted to present value, as explained in Note 1.18.2. A provision is then recognized based on the present value. The discounting reversal is recognized in Net financial expense.

As of December 31, 2004 and 2005, the rates applied for facilities located in France were the following:

- Inflation rate: 2%.
- Discount rate 5%.

Cost estimates will be updated if applicable regulations change or substantial technological developments are anticipated. In any event, the Group has set a goal of updating each estimate at least once every six years. In 2004, the Group updated its cost estimates for the La Hague and MELOX sites.

### *Waste retrieval and packaging*

Some waste from fuel treatment performed under older contracts could not be processed on site, as packaging facilities were not yet in service at that time. This waste must now be retrieved and packaged with methods and technologies approved by the French safety authorities. Some of these methods require additional studies.

In 2004, the Group performed a detailed review of its obligations in this area.

Operations funded by third parties are handled in the same way as for other types of contracts. These operations are included in services to optimize waste packaging routinely performed for customers at the La Hague plant. The customers retain ownership



of the packaged waste and must bear the cost of final disposal. In December 2004, the Group executed an agreement with the CEA formalizing its obligations. The cost of these operations is thus not included in the provision for end-of-life-cycle operations or in the corresponding third-party asset as of December 31, 2004. Upon receipt, the CEA's payment will be recognized as an advance. It will then be released to sales revenue as the work is performed. The same procedure will apply to EDF's share, once an agreement between the parties is executed.

Cost evaluations are based on technical assumptions and planning schedules.

Capital costs for waste retrieval are estimated based on a preliminary design and on Group estimates of operating costs for waste retrieval and packaging. The provision recognized to cover these expenses is calculated on a present value basis using the same principles and rates as for dismantling costs.

### **Final waste disposal**

AREVA recognizes a provision for radioactive waste expenses for which the Group is responsible.

These expenses include:

- the Group's share of the cost of monitoring disposal facilities in the Manche and Aube regions, which receive or will receive low-level, short-lived waste;
- the shipment and underground disposal of low-level, long-lived waste (graphite) owned by the Group;
- the shipment and disposal of medium and high-level waste covered by the French law of December 30, 1991 (now included in articles L.542-1 et seq. of the French environmental code). The provision is based on the assumption that a deep geological repository will be built.

For this particular cost, the Group considers that estimates are subject to uncertainties and decided to update the provisions as part of the transition to IFRS. In the financial statements as of June 30, 2005, AREVA added a 3% contingency to expenses prior to discounting, thus reducing the actual discount rate to 2%, i.e. the same as the projected rate of inflation.

A working group established in 2004 at the request of the Ministry of Industry's Department of Energy and Raw Materials (DGEMP) issued its report during the second half of 2005. AREVA reviewed the report of the working group and adopted a reasonable cost estimate of €14.1 billion for the deep geological disposal repository, including allowances for contingencies. The revised cost estimate is significantly higher than the one used previously by the Group to calculate its share of expenses. Consequently, the 3% risk premium included in the financial statements as of December 31, 2005 to cover these uncertainties was removed. Taking into account the disbursement schedule and a discount rate of 5%, the net present value of the provision is €409 million as of December 31, 2005, essentially unchanged from January 1, 2005.

This change in estimate has no significant impact on 2005 net income.

### **Provision for end-of-life-cycle operations, before discounting**

Provisions for end-life-cycle operations before discounting (subject to escalation from the date of closing):

<i>(in millions of euros)</i>	<b>December 31, 2005</b>	<b>December 31, 2004</b>
Decommissioning of nuclear facilities	7,053	6,814
Waste retrieval and packaging	2,106	1,444
<b>Total</b>	<b>9,159</b>	<b>8,258</b>

### **EDF/AREVA NC negotiations**

EDF and AREVA NC embarked on framework negotiations to establish:

Firstly:

- the legal and financial terms of a transfer to AREVA NC of EDF's current financial obligations with respect to dismantling operations at the La Hague site (including, conceivably, payment of a lump sum to settle EDF's long-term commitment). At the end of September 2003, the parties reached agreement on their respective shares of the dismantling costs for the La Hague plant;
- EDF's and AREVA NC's respective shares of obligations for the retrieval and packaging of waste at the La Hague and Saint-Laurent des Eaux sites.

Secondly:

- the financial terms of the future used fuel treatment contract beyond 2007.

Considering the global nature of this negotiation, AREVA did not modify in its financial statements for the year ended December 31, 2005, the respective shares of dismantling expenses allocated to the parties. Based on available information, this is not expected to have any significant impact on the Group's financial statements or financial position.

### **Funding of decommissioning and waste retrieval expenses**

AREVA has set aside a portion of its cash holdings to fund future decommissioning and waste retrieval operations through a special financial portfolio recognized in the balance sheet under "Asset earmarked for end-of-life-cycle operations" (see Note 14).



#### Annex 4:

### CEA List of facilities already decommissioned or in the course of decommissioning

Tableau I – Démantèlements CEA				
Exemples de réacteurs CEA définitivement arrêtés				
Installations	Début	Arrêt	Puissance (MWe)	Etat technique
EL1 (Zoé)	1948	1975	~ 0	Musée
G1 (Marcoule)	1956	1968	46	ICPE confiné
EL3 (Saclay)	1957	1979	18	Niveau 2
G2 (Marcoule)	1958	1980	250	Niveau 2
G3 (Marcoule)	1959	1984	250	Niveau 2
Rapsodie	1967	1983	40	Niveau 2
Siloë	1958	1996	50	Démantèlement en cours
EL <sub>4</sub>	1966	1985	250	Démantèlement en cours
Exemples d'installations CEA du cycle démantelées				
Installations	Vie	Objet	Etat	
Usine Pu (FAR)	1954-1958	Retraitement	Niveau 3 en 1962	
Le Bouchet	1959-1963	Traitement minéral	Niveau 3 en 1982	
Élan II A (Saclay)	1968-1970	Sources Cs	Niveau 3 en 1994	
Élan II B (La Hague)	1970-1973	Sources Cs	Niveau 3 en cours	
AT1 (La Hague)	1969-1979	Retraitement	Niveau 3 en 2001	
Piver (Marcoule)	1969-1982	Vitrification	Niveau 2 en 1991	
Bât. 19 (FAR)	1957-1984	Laboratoire plutonium	Niveau 3 en 1986	
RM2 (FAR)	1968-1984	Combustibles irradiés	Niveau 2 en 1998	
Bât. 18 (FAR)	1968-1992	Retraitement	Niveau 3 en cours	

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## Annex 5

### Excerpt of CEA Annual Report 2004, Notes 2 i) and 14

#### *i) Provisions for liabilities and charges*

In view of the way in which the CEA is financed, the commitments of the CEA to its staff, by way of retirement benefits and retirement pensions are not recorded as provisions, but as off-balance sheet liabilities, with the exception of those which are actually invoiced to clients, which will be recorded in a reserve for charges. In application of the provisions of CRC regulation no. 2000-06, relating to liabilities, the reserves connected with the dismantling of nuclear facilities correspond to the total cost of the operation, provided that the CEA is effectively the nuclear operator of the installation, or to the share attributable to it, through its past involvement in a programme or the joint operation of a facility where the CEA is not considered to be the nuclear operator. The counterpart entry of the reserves entered under liabilities is an account entitled "Dismantling assets" on the asset side of the balance sheet which is made up of several elements, depending on the anticipated financing:

- the share of the costs financed by the Civil Fund is entered under "Charges to be spread over several years" and is subject to depreciation in proportion to the anticipated operational life of the facilities entered under the Civil Fund;
- financing expected from third parties is entered in an account entitled "Dismantling assets to be financed by third parties". This asset is depreciated in the year the dismantling of the installation concerned takes place, in return for the proceeds invoiced to the third party to activate the CEA's outstanding claim vis-à-vis this third party, in application of the agreed contractual provisions;
- future financing expected from the State, either under the Defence Fund or as part of the annual budget subsidies, is entered in an account entitled "Dismantling assets to be financed by the State". This asset is depreciated each financial year on the basis of the expenditure actually incurred and financed by the grants received or to be received from the State over this financial year. This financing covers labour costs, the non-recoverable share of VAT and expenses on Defence Fund projects and projects in the Defence Sector. Reserves associated with the dismantling of nuclear facilities, the recovery and conditioning of waste, are assessed as follows:
  - inventory of the costs to remove all nuclear waste zones; the facilities and buildings retained

shall therefore be of a conventional type, without any radiological restriction;

- assessment of the expenditure on the basis of projected costs, taking into account the operational staff (operators) management staff and radiation protection staff, consumables and facilities, the treatment of linen and the resulting waste, including final disposal. The valuation also takes into account the projected monitoring costs, incurred during the operational phases and the technical support costs of the CEA units in charge of the dismantling operations;

- inclusion of VAT, calculated on the basis of the current VAT rate (19.60% as at 31 December 2004) and due against proportional share of deduction. Because of the wide variety of the facilities to be dismantled and as a result of the considerable variation in the facilities from one installation to another, the valuations are carried out using studies which are based on typical scenarios relating to the dismantling of typical cells corresponding to functions (cooling pond, pool, boiler equipment and plumbing, guttering...) to radiation and contamination levels and to levels of access and intervention (existence of facilities for handling and cutting inside the cell, etc.). These valuations are also based on orders or contracts and on internal estimates based on the knowledge of the subject and experience gained from work already completed or in progress. Future unit expenditure related to deep disposal is assessed on the basis:

- of the original estimate (€13.7 billion, 1997 economic conditions adjusted for the economic conditions of the financial year) of the laboratory research costs and the costs of construction and operation of the future repository;

- of the projected volumes of ILW-LL and HLW-LL waste to be produced by the CEA between now and 2070. These volumes are the result of estimates originally made by the nuclear partners in preparing the Andra convention of 6 June 2000, on the financing of studies concerning the establishment of a deep disposal repository. Similarly, under the aegis of the DGEMP (General Directorate for Energy and Raw Materials), a working group was set up in 2004 with representatives from Andra, EDF, Areva and the CEA. Its function is to establish a consensus on the basic assumptions, the calculation methods to be adopted and how uncertainties are

to be factored in for the establishment of reference costs for a deep geological repository. Thus:

- the basic details could change depending on the scenario decided on by the government and presented to Parliament,
- the CEA share, currently fixed at 17% (civil and defence sector), could change depending on the volumes produced by the CEA and the volumes produced by other producers,
- the cost of deep disposal will depend on the distribution between ILW-LL and HLWLL waste,
- the date of commencing industrial operation and its duration cannot be predicted with precision. The reserves recorded have been set up on a discounted basis (at a rate of 3%, not allowing for inflation) taking into account the dates these costs are to be incurred. The impact of this option on the level of the provision in the accounts is estimated to be around 50%. The effects of inflation and not applying a discount are taken into account each year on the balance sheet in addition to the provisions associated

with the dismantling of nuclear facilities, with the counterpart entry:

- of the financial result under the charge for the financial year and,

– of ‘Dismantling assets’ for the part relating to the previous financial years and financing to be received from third parties and the State. The part of the commitments still to be provided for is entered on the same basis in the Appendix under off-balance sheet liabilities. The valuation of end-of-cycle costs makes allowance for the uncertainty associated with the future development of processing technologies, purification of waste and facilities, as well as safety and security constraints and environmental considerations. 71 However, the values used represent the CEA’s best forecast as at the date of preparation of the year’s accounts. Any liabilities, corresponding to an obligation which is neither likely nor definite on the closing date, are not provided for. A note is made in the Appendix, if these are significant.

#### Note 14 – Dismantling assets

This heading records the assets entered in the counterpart account for reserves set up for the dismantling of nuclear facilities, the recovery and conditioning of waste.

Totalling €3,714 million as at 31/12/2004, it consists of:

- costs supported by the Civil Fund, still

to be spread over the residual life of the facilities, namely €83 million;

- future financing expected at fixed dates from third parties for their share in the cleanup costs of facilities, namely €128 million;

- future financing expected at fixed dates from the State for its commitments in the

Defence Fund for the UP1 and Ardemu programmes, for other Defence commitments, labour costs in respect of Civil Fund commitments and the share of non-recoverable VAT, namely €3,503 million.

The heading breaks down as follows:

	Total	Costs to be spread	Third party dismantling assets	State dismantling assets	
				Defence Fund	Other
<i>in millions of euros</i>					
Amount as at 31/12/2003	3,988	137	97	–	3,754
Transition to a discount rate of 3%	-272	-17	-7	–	-248
Spread of maturity falling after 30 years	-45	-31	–	–	-14
Creation of the Defence Fund	–	–	–	1,271	-1,271
2004 write back associated with the Defence Fund	-208	–	–	–	-208
Revaluation to 2004 economic conditions and non-application of discount	176	5	4	64	103
Realisations 2004	-186	-7	-2	-112	-65
Transfer of obligations to Cogema	-36	–	–	–	-36
Changes in estimates and payment schedules	334	-4	36	–	302
Change in proportion of VAT	-37	–	–	–	-37
<b>TOTAL</b>	<b>3,714</b>	<b>83</b>	<b>128</b>	<b>1,223</b>	<b>2,280</b>

## Annex 6

### **Secret défense : Lettre ouverte à l'attention des pouvoirs publics, 19 mai 2006**

"Au moment où le pouvoir politique marque sa volonté de rappeler le respect dû au secret défense en faisant interpellier Stéphane Lhomme, il est regrettable qu'il ignore les conclusions d'un très sérieux groupe de travail mis en place par la Commission Nationale du Débat Public, sur les obstacles à l'accès à l'information dans le domaine du nucléaire et sur les voies possibles pour progresser vers une véritable transparence. Les débats publics sur les déchets nucléaires et le futur réacteur EPR à Flamanville, qui viennent de s'achever, ainsi qu'une enquête menée à cette occasion sur les pratiques en matière de transparence dans divers pays occidentaux, démontrent la nécessité de pouvoir accéder aux documents d'expertise pour permettre une véritable démocratie participative en accord avec la Convention d'AARHUS ratifiée par la France.

Ces travaux ont montré l'intérêt d'une concertation sur ces questions et fait émerger des pistes de réflexions. Cette voie doit être poursuivie pour construire un dialogue argumenté sur des sujets complexes, touchant à un domaine aussi sensible que l'avenir énergétique, et pour éviter la radicalisation des positions à laquelle on assiste. Il ne suffit pas de ratifier des conventions ou de voter des lois pour que la transparence se fasse."

Des personnalités ayant participé aux débats publics déchets et EPR :

**Pierre Barbey** - Membre de l'Association de Contrôle de la Radioactivité dans l'Ouest

**David Boilley** – Membre de l'Association de Contrôle de la Radioactivité dans l'Ouest

**Jean-Claude Delalonde** – Président de l'Association Nationale de CLI

**Benjamin Dessus** – CNRS

**Danielle Faysse** - Membre de la Commission Particulière du débat Public EPR

**Bernard Laponche** - Expert indépendant, Global Chance

**Yves Marignac** – Directeur de Wise-Paris

**Jean-Luc Mathieu** – Membre de la Commission Nationale du Débat Public et

président de la Commission Particulière du débat public EPR

**Michèle Rivasi** – Présidente du CRIIREM (fondatrice de la CRIIRAD)

**François Rollinger** – Représentant CFDT au CSSIN

**Monique Sené** – Présidente du Groupement des Scientifiques pour l'Information sur l'Energie

**Annie Sugier** – Membre de la Commission Particulière du débat Public EPR

**Françoise Zonabend** - Membre de la Commission Particulière du débat Public EPR

# LOIS

## **LOI n° 2006-739 du 28 juin 2006 de programme relative à la gestion durable des matières et déchets radioactifs (1)**

NOR : ECOX0600036L

L'Assemblée nationale et le Sénat ont adopté,  
Le Président de la République promulgue la loi dont la teneur suit :

### **TITRE I<sup>er</sup>**

#### **POLITIQUE NATIONALE POUR LA GESTION DURABLE DES MATIÈRES ET DES DÉCHETS RADIOACTIFS**

##### **Article 1<sup>er</sup>**

L'intitulé du chapitre II du titre IV du livre V du code de l'environnement est ainsi rédigé : « Dispositions particulières à la gestion durable des matières et des déchets radioactifs ».

##### **Article 2**

L'article L. 542-1 du code de l'environnement est ainsi rédigé :

« *Art. L. 542-1.* – La gestion durable des matières et des déchets radioactifs de toute nature, résultant notamment de l'exploitation ou du démantèlement d'installations utilisant des sources ou des matières radioactives, est assurée dans le respect de la protection de la santé des personnes, de la sécurité et de l'environnement.

« La recherche et la mise en œuvre des moyens nécessaires à la mise en sécurité définitive des déchets radioactifs sont entreprises afin de prévenir ou de limiter les charges qui seront supportées par les générations futures.

« Les producteurs de combustibles usés et de déchets radioactifs sont responsables de ces substances, sans préjudice de la responsabilité de leurs détenteurs en tant que responsables d'activités nucléaires. »

##### **Article 3**

Pour assurer, dans le respect des principes énoncés à l'article L. 542-1 du code de l'environnement, la gestion des déchets radioactifs à vie longue de haute ou de moyenne activité, les recherches et études relatives à ces déchets sont poursuivies selon les trois axes complémentaires suivants :

1° La séparation et la transmutation des éléments radioactifs à vie longue. Les études et recherches correspondantes sont conduites en relation avec celles menées sur les nouvelles générations de réacteurs nucléaires mentionnés à l'article 5 de la loi n° 2005-781 du 13 juillet 2005 de programme fixant les orientations de la politique énergétique ainsi que sur les réacteurs pilotés par accélérateur dédiés à la transmutation des déchets, afin de disposer, en 2012, d'une évaluation des perspectives industrielles de ces filières et de mettre en exploitation un prototype d'installation avant le 31 décembre 2020 ;

2° Le stockage réversible en couche géologique profonde. Les études et recherches correspondantes sont conduites en vue de choisir un site et de concevoir un centre de stockage de sorte que, au vu des résultats des études conduites, la demande de son autorisation prévue à l'article L. 542-10-1 du code de l'environnement puisse être instruite en 2015 et, sous réserve de cette autorisation, le centre mis en exploitation en 2025 ;

3° L'entreposage. Les études et les recherches correspondantes sont conduites en vue, au plus tard en 2015, de créer de nouvelles installations d'entreposage ou de modifier des installations existantes, pour répondre aux besoins, notamment en termes de capacité et de durée, recensés par le plan prévu à l'article L. 542-1-2 du code de l'environnement.

##### **Article 4**

Pour assurer, dans le respect des principes énoncés à l'article L. 542-1 du code de l'environnement, la gestion des matières et des déchets radioactifs autres que ceux mentionnés à l'article 3 de la présente loi, il est institué un programme de recherche et d'études dont les objectifs sont les suivants :

1° La mise au point de solutions de stockage pour les déchets graphites et les déchets radifères, de sorte que le centre de stockage correspondant puisse être mis en service en 2013 ;

2° La mise au point pour 2008 de solutions d'entreposage des déchets contenant du tritium permettant la réduction de leur radioactivité avant leur stockage en surface ou à faible profondeur ;

3° La finalisation pour 2008 de procédés permettant le stockage des sources scellées usagées dans des centres existants ou à construire ;

4° Un bilan en 2009 des solutions de gestion à court et à long terme des déchets à radioactivité naturelle renforcée, proposant, s'il y a lieu, de nouvelles solutions ;

5° Un bilan en 2008 de l'impact à long terme des sites de stockage de résidus miniers d'uranium et la mise en œuvre d'un plan de surveillance radiologique renforcée de ces sites.

## Article 5

Après l'article L. 542-1 du code de l'environnement, il est inséré un article L. 542-1-1 ainsi rédigé :

« *Art. L. 542-1-1.* – Le présent chapitre s'applique aux substances radioactives issues d'une activité nucléaire visée à l'article L. 1333-1 du code de la santé publique ou d'une activité comparable exercée à l'étranger ainsi que d'une entreprise mentionnée à l'article L. 1333-10 du même code ou d'une entreprise comparable située à l'étranger.

« Une substance radioactive est une substance qui contient des radionucléides, naturels ou artificiels, dont l'activité ou la concentration justifie un contrôle de radioprotection.

« Une matière radioactive est une substance radioactive pour laquelle une utilisation ultérieure est prévue ou envisagée, le cas échéant après traitement.

« Un combustible nucléaire est regardé comme un combustible usé lorsque, après avoir été irradié dans le cœur d'un réacteur, il en est définitivement retiré.

« Les déchets radioactifs sont des substances radioactives pour lesquelles aucune utilisation ultérieure n'est prévue ou envisagée.

« Les déchets radioactifs ultimes sont des déchets radioactifs qui ne peuvent plus être traités dans les conditions techniques et économiques du moment, notamment par extraction de leur part valorisable ou par réduction de leur caractère polluant ou dangereux.

« L'entreposage de matières ou de déchets radioactifs est l'opération consistant à placer ces substances à titre temporaire dans une installation spécialement aménagée en surface ou en faible profondeur à cet effet, dans l'attente de les récupérer.

« Le stockage de déchets radioactifs est l'opération consistant à placer ces substances dans une installation spécialement aménagée pour les conserver de façon potentiellement définitive dans le respect des principes énoncés à l'article L. 542-1.

« Le stockage en couche géologique profonde de déchets radioactifs est le stockage de ces substances dans une installation souterraine spécialement aménagée à cet effet, dans le respect du principe de réversibilité. »

## Article 6

I. – Après l'article L. 542-1 du code de l'environnement, il est inséré un article L. 542-1-2 ainsi rédigé :

« *Art. L. 542-1-2.* – I. – Un plan national de gestion des matières et des déchets radioactifs dresse le bilan des modes de gestion existants des matières et des déchets radioactifs, recense les besoins prévisibles d'installations d'entreposage ou de stockage, précise les capacités nécessaires pour ces installations et les durées d'entreposage et, pour les déchets radioactifs qui ne font pas encore l'objet d'un mode de gestion définitif, détermine les objectifs à atteindre.

« Conformément aux orientations définies aux articles 3 et 4 de la loi n° 2006-739 du 28 juin 2006 de programme relative à la gestion durable des matières et des déchets radioactifs, le plan national organise la mise en œuvre des recherches et études sur la gestion des matières et des déchets radioactifs en fixant des échéances pour la mise en œuvre de nouveaux modes de gestion, la création d'installations ou la modification des installations existantes de nature à répondre aux besoins et aux objectifs définis au premier alinéa.

« Il comporte, en annexe, une synthèse des réalisations et des recherches conduites dans les pays étrangers.

« II. – Le plan national et le décret qui en établit les prescriptions respectent les orientations suivantes :

« 1° La réduction de la quantité et de la nocivité des déchets radioactifs est recherchée notamment par le traitement des combustibles usés et le traitement et le conditionnement des déchets radioactifs ;

« 2° Les matières radioactives en attente de traitement et les déchets radioactifs ultimes en attente d'un stockage sont entreposés dans des installations spécialement aménagées à cet usage ;

« 3° Après entreposage, les déchets radioactifs ultimes ne pouvant pour des raisons de sûreté nucléaire ou de radioprotection être stockés en surface ou en faible profondeur font l'objet d'un stockage en couche géologique profonde.

« III. – Le plan national est établi et mis à jour tous les trois ans par le Gouvernement. Il est transmis au Parlement, qui en saisit pour évaluation l'Office parlementaire d'évaluation des choix scientifiques et technologiques, et rendu public.

« IV. – Les décisions prises par les autorités administratives, notamment les autorisations mentionnées à l'article L. 1333-4 du code de la santé publique, doivent être compatibles avec les prescriptions du décret prévu au II du présent article. »



II. – Le plan national prévu à l'article L. 542-1-2 du code de l'environnement est établi pour la première fois avant le 31 décembre 2006.

### Article 7

Les propriétaires de déchets de moyenne activité à vie longue produits avant 2015 les conditionnent au plus tard en 2030.

### Article 8

I. – L'article L. 542-2 du code de l'environnement est ainsi rédigé :

« Art. L. 542-2. – Est interdit le stockage en France de déchets radioactifs en provenance de l'étranger ainsi que celui des déchets radioactifs issus du traitement de combustibles usés et de déchets radioactifs provenant de l'étranger. »

II. – Après l'article L. 542-2 du même code, sont insérés deux articles L. 542-2-1 et L. 542-2-2 ainsi rédigés :

« Art. L. 542-2-1. – I. – Des combustibles usés ou des déchets radioactifs ne peuvent être introduits sur le territoire national qu'à des fins de traitement, de recherche ou de transfert entre Etats étrangers.

« L'introduction à des fins de traitement ne peut être autorisée que dans le cadre d'accords intergouvernementaux et qu'à la condition que les déchets radioactifs issus après traitement de ces substances ne soient pas entreposés en France au-delà d'une date fixée par ces accords. L'accord indique les périodes prévisionnelles de réception et de traitement de ces substances et, s'il y a lieu, les perspectives d'utilisation ultérieure des matières radioactives séparées lors du traitement.

« Le texte de ces accords intergouvernementaux est publié au *Journal officiel*.

« II. – Les exploitants d'installations de traitement et de recherche établissent, tiennent à jour et mettent à la disposition des autorités de contrôle les informations relatives aux opérations portant sur des combustibles usés ou des déchets radioactifs en provenance de l'étranger. Ils remettent chaque année au ministre chargé de l'énergie un rapport comportant l'inventaire des combustibles usés et des déchets radioactifs en provenance de l'étranger ainsi que des matières et des déchets radioactifs qui en sont issus après traitement qu'ils détiennent, et leurs prévisions relatives aux opérations de cette nature. Ce rapport est rendu public.

« Art. L. 542-2-2. – I. – La méconnaissance des prescriptions des articles L. 542-2 et L. 542-2-1 est constatée, dans les conditions prévues à l'article L. 541-45, par les fonctionnaires et agents mentionnés aux 1°, 3°, 6° et 8° de l'article L. 541-44 ainsi que par les inspecteurs de la sûreté nucléaire et par des fonctionnaires et agents habilités à cet effet par le ministre chargé de l'énergie et assermentés.

« II. – La méconnaissance des prescriptions de l'article L. 542-2 et du I de l'article L. 542-2-1 est punie des peines prévues à l'article L. 541-46. En outre, sans préjudice de l'application des sanctions prévues au 8° de cet article, l'autorité administrative peut prononcer une sanction pécuniaire au plus égale, dans la limite de dix millions d'euros, au cinquième du revenu tiré des opérations réalisées irrégulièrement. La décision prononçant la sanction est publiée au *Journal officiel*.

« En cas de manquement aux obligations définies au II de l'article L. 542-2-1, l'autorité administrative peut prononcer une sanction pécuniaire au plus égale à 150 000 €.

« Les sommes sont recouvrées comme les créances de l'Etat étrangères à l'impôt et au domaine.

« Ces sanctions peuvent faire l'objet d'un recours de pleine juridiction. »

### Article 9

I. – L'article L. 542-3 du code de l'environnement est ainsi modifié :

1° Les I à V sont abrogés ;

2° Le premier alinéa du VI est remplacé par deux alinéas ainsi rédigés :

« Une commission nationale est chargée d'évaluer annuellement l'état d'avancement des recherches et études relatives à la gestion des matières et des déchets radioactifs par référence aux orientations fixées par le plan national prévu à l'article L. 542-1-2. Cette évaluation donne lieu à un rapport annuel qui fait également état des recherches effectuées à l'étranger. Il est transmis au Parlement, qui en saisit l'Office parlementaire d'évaluation des choix scientifiques et technologiques, et il est rendu public.

« La commission est composée des membres suivants, nommés pour six ans : » ;

3° Dans le 2° du même VI, les mots : « sur proposition de Conseil supérieur de la sûreté et de l'information nucléaires » sont remplacés par les mots : « sur proposition de l'Académie des sciences morales et politiques » ;

4° Dans le dernier alinéa du même VI, après les mots : « experts scientifiques », sont insérés les mots : « , dont au moins un expert international » ;

5° Le même VI est complété par cinq alinéas ainsi rédigés :

« Le mandat des membres de la commission est renouvelable une fois.

« La commission est renouvelée par moitié tous les trois ans. Pour la constitution initiale de la commission, le mandat de six de ses membres, désignés par tirage au sort, est fixé à trois ans.

« Le président de la commission est élu par les membres de celle-ci lors de chaque renouvellement triennal.

« Les membres de la commission exercent leurs fonctions en toute impartialité. Ils ne peuvent, directement ou indirectement, exercer de fonctions ni recevoir d'honoraires au sein ou en provenance des organismes évalués et des entreprises ou établissements producteurs ou détenteurs de déchets.

« Les organismes de recherche fournissent à la commission tout document nécessaire à sa mission. »

II. – La commission nationale mentionnée à l'article L. 542-3 du code de l'environnement établit son premier rapport avant le 30 juin 2007.

### **Article 10**

Le Haut Comité pour la transparence et l'information sur la sécurité nucléaire, créé par l'article 23 de la loi n° 2006-686 du 13 juin 2006 relative à la transparence et à la sécurité en matière nucléaire, organise périodiquement des concertations et des débats concernant la gestion durable des matières et des déchets nucléaires radioactifs.

## **TITRE II**

### **ORGANISATION ET FINANCEMENTS DE LA GESTION DURABLE DES MATIÈRES ET DES DÉCHETS RADIOACTIFS**

### **Article 11**

Dans l'article L. 542-6 du code de l'environnement, les mots : « des laboratoires » sont remplacés par les mots : « d'un laboratoire souterrain ou d'un centre de stockage en couche géologique profonde ».

### **Article 12**

Après l'article L. 542-10 du code de l'environnement, il est inséré un article L. 542-10-1 ainsi rédigé :

« *Art. L. 542-10-1.* – Un centre de stockage en couche géologique profonde de déchets radioactifs est une installation nucléaire de base.

« Par dérogation aux règles applicables aux autres installations nucléaires de base :

« – la demande d'autorisation de création doit concerner une couche géologique ayant fait l'objet d'études au moyen d'un laboratoire souterrain ;

« – le dépôt de la demande d'autorisation de création du centre est précédé d'un débat public au sens de l'article L. 121-1 sur la base d'un dossier réalisé par l'Agence nationale pour la gestion des déchets radioactifs créée à l'article L. 542-12 ;

« – la demande d'autorisation de création du centre donne lieu à un rapport de la commission nationale mentionnée à l'article L. 542-3, à un avis de l'Autorité de sûreté nucléaire et au recueil de l'avis des collectivités territoriales situées en tout ou partie dans une zone de consultation définie par décret ;

« – la demande est transmise, accompagnée du compte rendu du débat public, du rapport de la commission nationale mentionnée à l'article L. 542-3 et de l'avis de l'Autorité de sûreté nucléaire, à l'Office parlementaire d'évaluation des choix scientifiques et technologiques, qui l'évalue et rend compte de ses travaux aux commissions compétentes de l'Assemblée nationale et du Sénat ;

« – le Gouvernement présente ensuite un projet de loi fixant les conditions de réversibilité. Après promulgation de cette loi, l'autorisation de création du centre peut être délivrée par décret en Conseil d'Etat, pris après enquête publique ;

« – l'autorisation de création d'un centre de stockage en couche géologique profonde de déchets radioactifs ne garantissant pas la réversibilité de ce centre dans les conditions prévues par cette loi ne peut être délivrée.

« Lors de l'examen de la demande d'autorisation de création, la sûreté du centre est appréciée au regard des différentes étapes de sa gestion, y compris sa fermeture définitive. Seule une loi peut autoriser celle-ci. L'autorisation fixe la durée minimale pendant laquelle, à titre de précaution, la réversibilité du stockage doit être assurée. Cette durée ne peut être inférieure à cent ans.

« Les dispositions des articles L. 542-8 et L. 542-9 sont applicables à l'autorisation. »

### **Article 13**

L'article L. 542-11 du code de l'environnement est ainsi rédigé :

« *Art. L. 542-11.* – Dans tout département sur le territoire duquel est situé tout ou partie du périmètre d'un laboratoire souterrain ou d'un centre de stockage en couche géologique profonde défini à l'article L. 542-9, un groupement d'intérêt public est constitué en vue :



« 1° De gérer des équipements de nature à favoriser et à faciliter l'installation et l'exploitation du laboratoire ou du centre de stockage ;

« 2° De mener, dans les limites de son département, des actions d'aménagement du territoire et de développement économique, particulièrement dans la zone de proximité du laboratoire souterrain ou du centre de stockage dont le périmètre est défini par décret pris après consultation des conseils généraux concernés ;

« 3° De soutenir des actions de formation ainsi que des actions en faveur du développement, de la valorisation et de la diffusion de connaissances scientifiques et technologiques, notamment dans les domaines étudiés au sein du laboratoire souterrain et dans ceux des nouvelles technologies de l'énergie.

« Outre l'Etat et le titulaire des autorisations prévues aux articles L. 542-7 ou L. 542-10-1, peuvent adhérer de plein droit au groupement d'intérêt public la région, le département, les communes ou leurs groupements en tout ou partie situés dans la zone de proximité mentionnée au 2°.

« Les membres de droit du groupement d'intérêt public peuvent décider l'adhésion en son sein de communes ou de leurs groupements situés dans le même département et hors de la zone de proximité définie au 2°, dans la mesure où lesdits communes ou groupements justifient d'être effectivement concernés par la vie quotidienne du laboratoire ou du centre de stockage.

« Les dispositions des articles L. 341-2 à L. 341-4 du code de la recherche sont applicables au groupement.

« Pour financer les actions visées aux 1° et 2° du présent article, le groupement bénéficie d'une partie du produit de la taxe additionnelle dite "d'accompagnement" à la taxe sur les installations nucléaires de base prévue au V de l'article 43 de la loi de finances pour 2000 (n° 99-1172 du 30 décembre 1999), à laquelle il peut, pour les exercices budgétaires des années 2007 à 2016, ajouter une fraction, dans la limite de 80 %, de la partie du produit de la taxe additionnelle dite de "diffusion technologique" à ladite taxe sur les installations nucléaires de base dont il bénéficie. Pour financer les actions visées au 3° du présent article, le groupement bénéficie d'une partie du produit de la taxe additionnelle dite de "diffusion technologique", à laquelle il peut, pour les exercices budgétaires des années 2007 à 2016, ajouter une fraction, dans la limite de 80 %, de la partie du produit de la taxe additionnelle dite "d'accompagnement".

« Les personnes redevables de ces taxes additionnelles publient un rapport annuel sur les activités économiques qu'elles conduisent dans les départements visés au premier alinéa. »

## Article 14

Les 1° à 5° de l'article L. 542-12 du code de l'environnement sont remplacés par onze alinéas ainsi rédigés :

« 1° D'établir, de mettre à jour tous les trois ans et de publier l'inventaire des matières et déchets radioactifs présents en France ainsi que leur localisation sur le territoire national, les déchets visés à l'article L. 542-2-1 étant listés par pays ;

« 2° De réaliser ou faire réaliser, conformément au plan national prévu à l'article L. 542-1-2, des recherches et études sur l'entreposage et le stockage en couche géologique profonde et d'assurer leur coordination ;

« 3° De contribuer, dans les conditions définies à l'avant-dernier alinéa du présent article, à l'évaluation des coûts afférents à la mise en œuvre des solutions de gestion à long terme des déchets radioactifs de haute et de moyenne activité à vie longue, selon leur nature ;

« 4° De prévoir, dans le respect des règles de sûreté nucléaire, les spécifications pour le stockage des déchets radioactifs et de donner aux autorités administratives compétentes un avis sur les spécifications pour le conditionnement des déchets ;

« 5° De concevoir, d'implanter, de réaliser et d'assurer la gestion de centres d'entreposage ou des centres de stockage de déchets radioactifs compte tenu des perspectives à long terme de production et de gestion de ces déchets ainsi que d'effectuer à ces fins toutes les études nécessaires ;

« 6° D'assurer la collecte, le transport et la prise en charge de déchets radioactifs et la remise en état de sites de pollution radioactive sur demande et aux frais de leurs responsables ou sur réquisition publique lorsque les responsables de ces déchets ou de ces sites sont défaillants ;

« 7° De mettre à la disposition du public des informations relatives à la gestion des déchets radioactifs et de participer à la diffusion de la culture scientifique et technologique dans ce domaine ;

« 8° De diffuser à l'étranger son savoir-faire.

« L'agence peut obtenir le remboursement des frais exposés pour la gestion des déchets radioactifs pris en charge sur réquisition publique des responsables de ces déchets qui viendraient à être identifiés ou qui reviendraient à meilleure fortune.

« L'agence propose au ministre chargé de l'énergie une évaluation des coûts afférents à la mise en œuvre des solutions de gestion à long terme des déchets radioactifs de haute et de moyenne activité à vie longue selon leur nature. Après avoir recueilli les observations des redevables des taxes additionnelles mentionnées au V de l'article 43 de la loi de finances pour 2000 (n° 99-1172 du 30 décembre 1999) et l'avis de l'Autorité de sûreté nucléaire, le ministre chargé de l'énergie arrête l'évaluation de ces coûts et la rend publique.

« L'agence peut conduire, avec toute personne intéressée, des actions communes d'information du public et de diffusion de la culture scientifique et technologique. »

### Article 15

Après l'article L. 542-12 du code de l'environnement, il est inséré un article L. 542-12-1 ainsi rédigé :

« *Art. L. 542-12-1.* – Il est institué, au sein de l'Agence nationale pour la gestion des déchets radioactifs, un fonds destiné au financement des recherches et études sur l'entreposage et le stockage en couche géologique profonde des déchets radioactifs. Les opérations de ce fonds font l'objet d'une comptabilisation distincte permettant d'individualiser les ressources et les emplois du fonds au sein du budget de l'agence. Le fonds a pour ressources le produit de la taxe dite de "recherche" additionnelle à la taxe sur les installations nucléaires de base prévue au V de l'article 43 de la loi de finances pour 2000 (n° 99-1172 du 30 décembre 1999).

« L'agence dispose d'une subvention de l'Etat qui contribue au financement des missions d'intérêt général qui lui sont confiées en application des dispositions des 1° et 6° de l'article L. 542-12. »

### Article 16

Après l'article L. 542-12 du code de l'environnement, il est inséré un article L. 542-12-2 ainsi rédigé :

« *Art. L. 542-12-2.* – Il est institué, au sein de l'Agence nationale pour la gestion des déchets radioactifs, un fonds destiné au financement de la construction, de l'exploitation, de l'arrêt définitif, de l'entretien et de la surveillance des installations d'entreposage ou de stockage des déchets de haute ou de moyenne activité à vie longue construites ou exploitées par l'agence. Les opérations de ce fonds font l'objet d'une comptabilisation distincte permettant d'individualiser les ressources et les emplois du fonds au sein du budget de l'agence. Le fonds a pour ressources les contributions des exploitants d'installations nucléaires de base définies par des conventions.

« Si l'autorité administrative constate que l'application des dispositions de l'article 20 de la loi n° 2006-739 du 28 juin 2006 de programme relative à la gestion durable des matières et des déchets radioactifs est susceptible d'être entravée, elle peut imposer, le cas échéant sous astreinte, à l'exploitant d'une installation nucléaire de base de verser au fonds les sommes nécessaires à la couverture des charges mentionnées au I du même article 20. »

### Article 17

Les subventions de l'Etat aux organismes participant aux recherches mentionnées au 1° de l'article 3 sont complétées par des contributions des exploitants d'installations nucléaires de base définies par convention entre ces organismes et eux.

### Article 18

L'article L. 542-13 du code de l'environnement est ainsi modifié :

1° Le premier alinéa est ainsi rédigé :

« Il est créé, auprès de tout laboratoire souterrain, un comité local d'information et de suivi chargé d'une mission générale de suivi, d'information et de concertation en matière de recherche sur la gestion des déchets radioactifs et, en particulier, sur le stockage de ces déchets en couche géologique profonde. » ;

2° Les deuxième et troisième alinéas sont ainsi rédigés :

« Ce comité comprend des représentants de l'Etat, deux députés et deux sénateurs désignés par leur assemblée respective, des élus des collectivités territoriales consultées à l'occasion de l'enquête publique ou concernées par les travaux de recherche préliminaires prévus à l'article L. 542-6, des représentants d'associations de protection de l'environnement, de syndicats agricoles, d'organisations professionnelles, d'organisations syndicales de salariés représentatives et de professions médicales, des personnalités qualifiées ainsi que le titulaire de l'autorisation prévue à l'article L. 542-10-1.

« Il peut être doté de la personnalité juridique avec un statut d'association. Il est présidé par un de ses membres, élu national ou local, nommé par décision conjointe des présidents des conseils généraux des départements sur lesquels s'étend le périmètre du laboratoire. » ;

3° Dans la dernière phrase du quatrième alinéa, les mots : « d'évaluation » sont supprimés ;

4° La dernière phrase du quatrième alinéa est complétée par les mots : « et le Haut Comité pour la transparence et l'information sur la sécurité nucléaire créé par l'article 23 de la loi n° 2006-686 du 13 juin 2006 relative à la transparence et à la sécurité en matière nucléaire » ;

5° Le quatrième alinéa est complété par une phrase ainsi rédigée : « La commission nationale présente chaque année, devant le comité local d'information et de suivi, son rapport d'évaluation sur l'état d'avancement des recherches dans les trois axes de recherche définis par l'article 3 de la loi n° 2006-739 du 28 juin 2006 de programme relative à la gestion durable des matières et des déchets radioactifs. » ;

6° Après le quatrième alinéa, il est inséré un alinéa ainsi rédigé :

« La commission locale d'information et de suivi et le Haut Comité pour la transparence et l'information sur la sécurité nucléaire créé par l'article 23 de la loi n° 2006-686 du 13 juin 2006 précitée se communiquent tous les renseignements utiles à l'exercice de leurs missions et concourent à des actions communes d'information. » ;

7° Après le mot : « sont », la fin du dernier alinéa est ainsi rédigée : « financés à parité d'une part par des subventions de l'Etat, d'autre part par des subventions des entreprises concernées par l'activité de stockage des déchets radioactifs en couche géologique profonde. »

### Article 19

Le dernier alinéa de l'article L. 515-7 du code de l'environnement est ainsi rédigé :

« Les dispositions du présent article ne s'appliquent pas au stockage des déchets radioactifs. »

### Article 20

I. – Les exploitants d'installations nucléaires de base évaluent, de manière prudente, les charges de démantèlement de leurs installations ou, pour leurs installations de stockage de déchets radioactifs, leurs charges d'arrêt définitif, d'entretien et de surveillance. Ils évaluent de la même manière, en prenant notamment en compte l'évaluation fixée en application de l'article L. 542-12 du code de l'environnement, les charges de gestion de leurs combustibles usés et déchets radioactifs.

II. – Les exploitants d'installations nucléaires de base constituent les provisions afférentes aux charges mentionnées au I et affectent à titre exclusif à la couverture de ces provisions les actifs nécessaires.

Ils comptabilisent de façon distincte ces actifs qui doivent présenter un degré de sécurité et de liquidité suffisant pour répondre à leur objet. Leur valeur de réalisation est au moins égale au montant des provisions mentionnées au premier alinéa du présent II, à l'exclusion de celles liées au cycle d'exploitation.

A l'exception de l'Etat dans l'exercice des pouvoirs dont il dispose pour faire respecter par les exploitants leurs obligations de démantèlement de leurs installations et de gestion de leurs combustibles usés et déchets radioactifs, nul ne peut se prévaloir d'un droit sur les actifs mentionnés au premier alinéa du présent II, y compris sur le fondement du livre VI du code de commerce.

III. – Les exploitants transmettent tous les trois ans à l'autorité administrative un rapport décrivant l'évaluation des charges mentionnées au I, les méthodes appliquées pour le calcul des provisions afférentes à ces charges et les choix retenus en ce qui concerne la composition et la gestion des actifs affectés à la couverture des provisions. Ils transmettent tous les ans à l'autorité administrative une note d'actualisation de ce rapport et l'informent sans délai de tout événement de nature à en modifier le contenu. Ils communiquent à sa demande à l'autorité administrative copie de tous documents comptables ou pièces justificatives.

Si l'autorité administrative relève une insuffisance ou une inadéquation dans l'évaluation des charges, le calcul des provisions ou le montant, la composition ou la gestion des actifs affectés à ces provisions, elle peut, après avoir recueilli les observations de l'exploitant, prescrire les mesures nécessaires à la régularisation de sa situation en fixant les délais dans lesquels celui-ci doit les mettre en œuvre.

En cas d'inexécution de ces prescriptions dans le délai imparti, l'autorité administrative peut ordonner, sous astreinte, la constitution des actifs nécessaires ainsi que toute mesure relative à leur gestion.

Les exploitants transmettent, au plus tard dans un délai d'un an à compter de la publication de la présente loi, leur premier rapport triennal mentionné au premier alinéa du présent III. Ce premier rapport comprend, outre les éléments prévus au premier alinéa du présent III, un plan de constitution des actifs définis au II du présent article.

Les exploitants mettent en œuvre le plan de constitution d'actifs au plus tard dans un délai de cinq ans à compter de la publication de la présente loi.

IV. – Il est créé une Commission nationale d'évaluation du financement des charges de démantèlement des installations nucléaires de base et de gestion des combustibles usés et des déchets radioactifs.

La commission évalue le contrôle de l'adéquation des provisions prévues au II aux charges mentionnées au I et de la gestion des actifs visés au II ainsi que la gestion des fonds mentionnés aux articles L. 542-12-1 et L. 542-12-2 du code de l'environnement.

Elle peut, à tout moment, adresser au Parlement et au Gouvernement des avis sur les questions relevant de sa compétence. Ses avis peuvent être rendus publics. Elle remet au Parlement et au Haut Comité pour la transparence et l'information sur la sécurité nucléaire créé par l'article 23 de la loi n° 2006-686 du 13 juin 2006 relative à la transparence et à la sécurité en matière nucléaire, tous les trois ans, un rapport présentant l'évaluation mentionnée à l'alinéa précédent. Ce rapport est rendu public.

La commission est composée :

- 1° Des présidents des commissions de l'Assemblée nationale et du Sénat compétentes en matière d'énergie ou chargées des finances, ou de leur représentant ;
- 2° De quatre personnalités qualifiées désignées à parité par l'Assemblée nationale et par le Sénat ;
- 3° De quatre personnalités qualifiées désignées par le Gouvernement.

Les personnalités qualifiées sont désignées pour six ans.

La commission reçoit communication des rapports mentionnés au III. Elle peut demander aux exploitants communication de tous documents nécessaires à l'accomplissement de ses missions. Elle peut entendre l'autorité administrative mentionnée au III.

La commission remet son premier rapport au plus tard dans un délai de deux ans à compter de la publication de la présente loi.

Pendant la durée de leurs fonctions, les personnalités qualifiées membres de la commission ne prennent aucune position publique sur des sujets relevant de la compétence de celle-ci. Pendant la durée de leurs fonctions et après celle-ci, les membres de la commission sont tenus au secret professionnel pour les faits, actes et renseignements dont ils ont pu avoir connaissance en raison de leurs fonctions.

Les membres de la commission ne peuvent, directement ou indirectement, exercer de fonctions ni recevoir d'honoraires au sein ou en provenance des exploitants d'installations nucléaires de base ou d'autres entreprises du secteur de l'énergie.

V. – Un décret détermine, en tant que de besoin, les conditions et modalités d'application du présent article, notamment dans le respect des normes comptables applicables, les modalités d'évaluation des charges mentionnées au I et de calcul des provisions prévues au II, ainsi que les informations que les exploitants sont tenus de rendre publiques et les règles de publicité y afférentes.

Le présent article, à l'exception des dispositions du I, n'est pas applicable aux installations nucléaires de base exploitées directement par l'Etat. Les personnes n'exploitant plus d'installation nucléaire de base sont assimilées, pour l'application des dispositions du présent article relatives à la gestion de leurs combustibles usés et déchets radioactifs, aux exploitants de telles installations.

### Article 21

I. – L'article 43 de la loi de finances pour 2000 (n° 99-1172 du 30 décembre 1999) est complété par un V ainsi rédigé :

« V. – Il est créé trois taxes additionnelles à la taxe sur les installations nucléaires de base. Le montant de ces taxes additionnelles, dites respectivement de "recherche", "d'accompagnement" et de "diffusion technologique", est déterminé, selon chaque catégorie d'installations, par application d'un coefficient multiplicateur à une somme forfaitaire. Les coefficients sont fixés par décret en Conseil d'Etat après avis des conseils généraux concernés et des groupements d'intérêt public définis à l'article L. 542-11 du code de l'environnement pour ce qui concerne les taxes dites "d'accompagnement" et de "diffusion technologique", dans les limites indiquées dans le tableau ci-dessous et des besoins de financement, en fonction des quantités et de la toxicité des colis de déchets radioactifs produits et à produire ne pouvant pas être stockés en surface ou en faible profondeur que peut produire chaque catégorie d'installations.

CATÉGORIE	SOMMES FORFAITAIRES Déchets (en millions d'euros)	COEFFICIENT MULTIPLICATEUR		
		Recherche	Accompagnement	Diffusion technologique
Réacteurs nucléaires de production d'énergie autres que ceux consacrés à titre principal à la recherche (par tranche) .....	0,28	[0,5-5]	[0,6-2]	[0,6-1]
Réacteurs nucléaires de production d'énergie consacrés à titre principal à la recherche .....	0,25	[0,5-5]	[0,6-2]	[0,6-1]
Autres réacteurs nucléaires .....	0,25	[0,5-5]	[0,6-2]	[0,6-1]
Usines de traitement de combustibles nucléaires usés .....	0,28	[0,5-5]	[0,6-2]	[0,6-1]

« Les taxes additionnelles sont recouvrées dans les mêmes conditions et sous les mêmes sanctions que la taxe sur les installations nucléaires de base.

« Sous déduction des frais de collecte fixés à 1 % des sommes recouvrées, le produit de la taxe additionnelle dite de "recherche" est reversé à l'Agence nationale pour la gestion des déchets radioactifs.

« Sous déduction des frais de collecte fixés à 1 % des sommes recouvrées, le produit de la taxe additionnelle dite "d'accompagnement" est réparti, à égalité, en un nombre de parts égal au nombre de départements mentionnés à l'article L. 542-11 du code de l'environnement. Une fraction de chacune de ces parts, déterminée par décret en Conseil d'Etat dans la limite de 20 %, est reversée par les groupements d'intérêt public mentionnés au même article L. 542-11, au prorata de leur population, aux communes du département dont une partie du territoire est distante de moins de 10 kilomètres de l'accès principal aux installations souterraines d'un laboratoire souterrain mentionné à l'article L. 542-4 du même code ou d'un centre de stockage en couche géologique profonde mentionné à l'article L. 542-10-1 du même code. Le solde de chacune de ces parts est reversé au groupement d'intérêt public mentionné à l'article L. 542-11 du même code.

« Sous déduction des frais de collecte fixés à 1 % des sommes recouvrées, le produit de la taxe additionnelle dite de "diffusion technologique" est reversé aux groupements d'intérêt public mentionnés à l'article L. 542-11 du même code à égalité entre eux. »

II. – Les dispositions du I sont applicables à compter du 1<sup>er</sup> janvier 2007.

### TITRE III

#### CONTRÔLES ET SANCTIONS

##### Article 22

Tout responsable d'activités nucléaires et toute entreprise mentionnée à l'article L. 1333-10 du code de la santé publique est tenu d'établir, de tenir à jour et de mettre à la disposition de l'autorité administrative et, pour ce qui relève de sa compétence, de l'Agence nationale pour la gestion des déchets radioactifs, les informations nécessaires à l'application et au contrôle des dispositions de la présente loi.

Sans préjudice des dispositions du III de l'article 20, un décret en Conseil d'Etat précise celles de ces informations qui font l'objet d'une transmission périodique à l'autorité administrative ou à l'Agence nationale pour la gestion des déchets radioactifs.

##### Article 23

En cas de manquement de l'exploitant d'une installation nucléaire de base aux obligations définies aux I et II de l'article 20, l'autorité administrative peut, sans préjudice des mesures prévues au III du même article, prononcer une sanction pécuniaire dont le montant n'excède pas 5 % de la différence entre le montant des actifs constitués par l'exploitant d'une installation nucléaire de base et celui prescrit par l'autorité administrative. La décision prononçant la sanction est publiée au *Journal officiel*.

En cas de manquement aux obligations d'information prévues au III de l'article 20 et à l'article 22, l'autorité administrative peut prononcer une sanction pécuniaire au plus égale à 150 000 €.

Les sommes sont recouvrées comme les créances de l'Etat étrangères à l'impôt et au domaine.

Les sanctions prévues au présent article peuvent faire l'objet d'un recours de pleine juridiction.

##### Article 24

Un décret en Conseil d'Etat fixe, en tant que de besoin, les modalités d'application de la présente loi.

La présente loi sera exécutée comme loi de l'Etat.

Fait à Paris, le 28 juin 2006.

JACQUES CHIRAC

Par le Président de la République :

*Le Premier ministre,*

DOMINIQUE DE VILLEPIN

*Le ministre d'Etat,  
ministre de l'intérieur  
et de l'aménagement du territoire,*  
NICOLAS SARKOZY

*La ministre de la défense,*  
MICHÈLE ALLIOT-MARIE

*Le ministre des affaires étrangères,*  
PHILIPPE DOUSTE-BLAZY

*Le ministre de l'économie,  
des finances et de l'industrie,*  
THIERRY BRETON

*Le ministre de l'éducation nationale,  
de l'enseignement supérieur  
et de la recherche,*  
GILLES DE ROBIEN

*Le ministre de la santé et des solidarités,*  
XAVIER BERTRAND

*La ministre de l'écologie  
et du développement durable,*  
NELLY OLIN

*Le ministre délégué  
à l'enseignement supérieur  
et à la recherche,*  
FRANÇOIS GOULARD

*Le ministre délégué à l'industrie,*  
FRANÇOIS LOOS

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(1) *Travaux préparatoires* : loi n° 2006-739.

*Assemblée nationale :*

Projet de loi n° 2977 ;

Rapport de M. Claude Birraux, au nom de la commission des affaires économiques, n° 3003 ;

Discussion les 6, 11 et 12 avril 2006 et adoption, après déclaration d'urgence, le 12 avril 2006.

*Sénat :*

Projet de loi, adopté par l'Assemblée nationale, n° 315 (2005-2006) ;

Rapport de M. Henri Revol, au nom de la commission des affaires économiques, n° 358 (2005-2006) ;

Discussion le 30 mai 2006 et adoption le 31 mai 2006.

*Assemblée nationale :*

Projet de loi, modifié par le Sénat, n° 3121 ;

Rapport de M. Claude Birraux, au nom de la commission des affaires économiques, n° 3154 ;

Discussion et adoption le 15 juin 2006.